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Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

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Includes information storage and retrieval technology; micrography; and library science.
For computer documentation see *61 Computer Programming and Software.*

83 ECONOMICS AND COST ANALYSIS N.A.
Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE N.A.
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 3030
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences.*

88 SPACE SCIENCES (GENERAL) N.A.

89 ASTRONOMY 3031
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 3031
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 3032
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance.* For space stations see *15 Launch Vehicles and Space Vehicles.*

92 SOLAR PHYSICS 3032
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION 3033
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine.* For theory see *73 Nuclear and High-Energy Physics.*

GENERAL

99 GENERAL N.A.

Note: N.A. means that no abstracts were assigned to this category for this issue.

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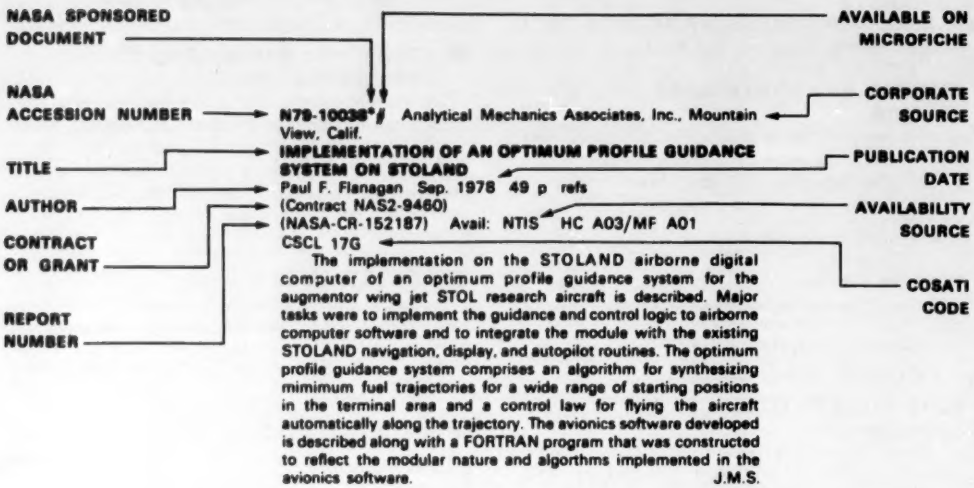
TYPICAL CITATION AND ABSTRACT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N79-10038*# Analytical Mechanics Associates, Inc., Mountain View, Calif.
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TITLE
IMPLEMENTATION OF AN OPTIMUM PROFILE GUIDANCE SYSTEM ON STOLAND
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The implementation on the STOLAND airborne digital computer of an optimum profile guidance system for the augmentor wing jet STOL research aircraft is described. Major tasks were to implement the guidance and control logic to airborne computer software and to integrate the module with the existing STOLAND navigation, display, and autopilot routines. The optimum profile guidance system comprises an algorithm for synthesizing mimimum fuel trajectories for a wide range of starting positions in the terminal area and a control law for flying the aircraft automatically along the trajectory. The avionics software developed is described along with a FORTRAN program that was constructed to reflect the modular nature and algorithms implemented in the avionics software. J.M.S.

ON-GOING RESEARCH PROJECTS

This is a listing of research projects - not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, ANALYTICAL MODEL OF A JET-DIFFUSER EJECTOR FOR WATER PROPULSION

M. Alperin, Flight Dynamics Research Corp., *15809 Stagg St., Van Nuys, California* 91406 (DN775403; N00014-77-C-0294)

To formulate an analytical model of a jet-diffuser ejector.

Derive the relationships to predict the performance of a two-dimensional jet-diffuser ejector in motion in its thrust direction for incompressible flow including the effects of cavitation and viscous dissipation within the ejector.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

1.0002, DESIGN STUDY OF THERMOPLASTIC WING

Unknown, General Dynamics Corp., Convair Division, *P.O. Box 1950, San Diego, California* 92112 (DN890062; N00019-78-C-0083)

Identify fiber reinforced thermoplastic wing design approaches compatible with manufacturing/quality assurance capabilities for these materials and their associated weight/cost attributes.

Conduct design and analysis trade studies to identify weight, cost and other functional characteristics of alternative wing designs. Build and test critical subelements to support the analyses.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0003, DEVELOP A COLOR ALPHA-NUMERIC LIQUID CRYSTAL DISPLAY

J. Gunther, Hughes Aircraft Co., *Centinela Ave. & Teale St., Culver City, California* 90230 (DN881386; N62269-77-C-0477)

The Navy's advanced integrated display system (AIDS) program is to develop a totally new concept in modular cockpit instrumentation for naval air missions, requiring exploratory development of new display materials and techniques. A flat panel display with color features is directly applicable to the type of display required by AIDS for the master monitor display and the programmable panel display. This contract supports work unit ZA601, Agency Accession No. 681080.

A liquid crystal matrix display, currently being developed by the contractor, will be combined with a multicolor filter to produce a display module displaying alpha numerics and symbology in multicolor. Drive circuits are to be designed and fabricated for this matrix display, operating from an existing symbol generator.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

1.0004, OSMOTIC AND CAPILLARY PUMPED HEAT PIPES

G.L. Fleischman, Hughes Aircraft Co., *3100 W. Lomita Blvd., Torrance, California* 90509 (DF139780; F33615-77-C-3031)

Advanced aircraft generate large amounts of heat in critical components for which current cooling and thermal controls are inadequate. Better heat transfer devices are needed to conduct heat loads from temperature critical areas to maintain thermal control. Examples of thermal control problem areas are advanced aircraft environmental control systems which have complex controls requiring high heat rejection rates. Also, large amounts of heat are generated in aircraft wheels and tires for which heat buildup is more rapid than heat rejection. Current heat pipes having high transfer rates have limited application in large heat load transfer due to capillary pumping limits. The objective is the design and evaluation of osmotic heat pumping devices with a big payoff in the enhanced heat transport. Better thermal control of aircraft environments and other aircraft components in critical thermal areas will result in greater reliability of aircraft components with fewer failures due to high temperatures.

A contractual effort will be conducted in which experimental osmotic heat pipe designs will be evaluated, fabricated and tested, under simulation of high-temperature conditions for concept verification. After demonstration of the experimental heat pipe, a new heat pipe designed for a specific application will be fabricated for testing at AFFDL.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0005, WIND-TUNNEL TESTING OF A WING/STORE FLUTTER PREVENTION SYSTEM

C. Hwang, Northrop Corp., *3901 W. Broadway, Hawthorne, California* 90250 (DF133940; F33615-76-C-3039)

High-performance fighter-attack aircraft are required to carry many combinations of external wing-mounted stores to obtain operational effectiveness in regards to the combat role. However, some wing/store configurations are found to be critical from the standpoint of preventing flutter from occurring within the desired operational flight envelope. Speed placards are the only suitable means of preventing this flutter, but this technique generally results in significant losses in aircraft performance. The objective of this program is to investigate, via wind-tunnel testing of an aeroelastic model with external stores, the potential capability of an adaptable flutter suppression system of removing flutter speed restrictions. The technology gained from this program will ultimately result in an expanded attack envelope, increased survivability (reduced cost per target kill) and improved operational flexibility on fighter aircraft with an air-to-ground mission.

An aeroelastic wind tunnel model of a fighter aircraft configuration will be designed and fabricated. A miniature flutter suppression system will be synthesized, constructed and implemented within this model. The active system will be mechanized with digital logic and electro-hydraulic actuation, and will be capable of adapting to prevent the flutter modes of several wing/store configurations. Finally, wind-tunnel tests will be conducted to evaluate several important design parameters.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0006, AIRCRAFT TRANSPARENCY FAILURE AND COST ANALYSIS

W.D. Dotseth, Rockwell International Corp., *International Airport, Los Angeles, California* (DF140130; F33615-77-C-3060)

The logistics or ownership cost of current aircraft transparency systems varies radically for each new system and cannot be accurately predicted. This is not only true for the replacement costs but also for the initial development costs where different design concepts are being considered. The costs are highly sensitive to the particular design configuration. The objective of this effort is to define the most significant design parameters affecting the logistics costs of aircraft transparency systems for current inventory aircraft and project the ownership costs for future systems such as the B-1 and F-16. Corrective programs to reduce AFLC support costs will be recommended.

An initial data search utilizing current AFLC data systems has yielded work unit code reliability, maintainability and logistics support cost information on 20 aircraft transparency systems. The approach is to conduct a combined USAF and contractor field audit at the AFLC AMA's to correlate the initial data search information with actual field experience. Hardware design information, design and test requirements and certification/qualification test results will be collected for each of the systems. A resulting analytical analysis will be conducted to establish the failure/cost relationships with the transparency design parameters.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0007, OPTIMAL COMPUTER AIDED CONTROL ANALYSIS/SYNTHESIS METHODS

R.F. Whitbeck, Systems Technology Inc., *13766 S. Hawthorne Blvd., Hawthorne, California* 90250 (DF139470; F33615-77-C-3026)

This work unit supports TPO 3, Flight Control, and specific goal FG02A, Flying Qualities and Development Criteria. Specifically it addresses the problems of designing a digital flight control without adversely affecting aircraft flying qualities. Current design practice for digital flight control systems is to first develop a good analog design and then emulate it digitally. This leads to high sample rate systems with problems of computation time delays, excessive work length requirements and internal noise. One dominant reason for the current design procedure is reliance on system design criteria postulated for analog systems. The objective of this effort is to develop flight control design criteria applicable to direct digital design theory in order to take better advantage of digital system characteristics. Flying qualities and the total system's sensitivity to uncertainty in definition of the airplane's characteristics are format considerations in the development of new-design criteria for digital systems. This effort will provide design criteria for future military aircraft flight controls that will insure optimum use of digital flight control advantages, considering both cost and performance, while providing adequate flying qualities for the mission.

The latest direct digital design methodologies including discrete optimal control theory will be reviewed and codified regarding their applicability to the design of complex aircraft flight controls. Various sampling rates and types of sampling as well as different types of data holds will be considered. Current flying qualities design criteria will be reviewed and evaluated with respect to their applicability or compatibility with digital control design theory. Revision or replacement of flying qualities criteria will be recommended where possible. Research to develop new criteria or merge flying qualities and digital control criteria will be defined where necessary. Proposed new or revised design criteria will be validated by application to realistic advanced flight control design problems and evaluation of the results.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0008, EXPLORATORY INVESTIGATION OF DEPLOYABLE DRAG DEVICES AS A MEANS TO CONTROL DISABLED HELICOPTERS

D. Goodrich, U.S. Dept. of Defense, Navy, National Parachute Test Range, *El Centro, California* 92243 (DN895419)

To establish the feasibility of using deployable drag devices as a means of improving the control and stability of single rotor helicopters disabled by loss of the anti-torque (tail) rotor. The drag device will be stowed within the fuselage in the vicinity of the tail where upon pilot actuation, it will deploy. The device acts as an aerodynamic drag to partially provide a rotor torque-resisting moment. Thus, flight is permitted to continue with limited maneuverability and an improved landing capability.

Review available single-rotor helicopter accident data aerodynamic characteristics and performance parameters. Analytically size an appropriate drag device and predict its impact on performance and control in typical (no tail rotor) malfunction situations. Conduct subscale wind tunnel tests, and full scale flight tests to verify and optimize performance. Two alternative concepts will be covered: (a) deploying a conventional parachute; (b) deploying a semi-rigid vertical fin.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

1.0009, VALIDATION OF AIR QUALITY ASSESSMENT MODEL FOR NAVAL AIR OPERATIONS

D.W. Netzer, U.S. Dept. of Defense, Navy, Naval Postgraduate School, *Monterey, California* 93940 (DN898054)

(a) Experimentally determine the effects of vehicle velocity, jet turbulence intensity, and ambient turbulence intensity on jet dispersion rates. Incorporate data for sigma sub y and sigma sub z and plume rise into AQAM as required. (b) Assist NAPC or their designates in becoming operationally familiar with AQAM for naval air operations.

All basic experimental equipment (wind tunnel modifications, thermocouple rake, hot wire, etc.) will have been constructed in FY 78. The remaining tasks will be to incorporate means for providing realistic variations in the turbulence intensity profiles and a translating jet exhaust. (a) Modify jet apparatus (which can be translated in the vertical direction) to allow for acceleration along the simulated runway. (b) Incorporate boundary layer trips and free stream grids to simulate realistic variations in the ambient turbulence intensity and scale. (c) Use FY 78 data together with new data for final update of AQAM dispersion routine.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Propulsion Test Center

1.0010, RESEARCH IN AERODYNAMICS

I.C. Statler, U.S. National Aeronautics & Space Admin., Office of Aeronautics & Space Technology, Ames Research Center, *Moffett Field, California* 94035 (DA0C5001)

To expand the technologies in those areas which are most likely to impact improved operational and cost-effectiveness, survivability and safety of future Army airmobile systems. Analytical and experimental studies are selected on the basis of a continual review of the Army's aviation objectives and assessment of those fundamental technological deficiencies which would prevent achievement of the desired objectives.

Rotary-wing research will be conducted through joint participation with NASA to develop or improve analytical tools, prediction techniques, and fundamental understanding related to basic fluid mechanics, rotary-wing airfoils, acoustics, rotary wing dynamics and control, and flight simulation.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Aeromechanics Lab.

1.0011, AUTOROTATION MANEUVER CHARACTERISTICS OF HELICOPTERS

R.E. Studwell, United Technologies Corp., Sikorsky Aircraft Division, *Sunnyvale, California* 94088 (DA0D4077; DAAJ02-76-C-0066)

A mathematical model for evaluating the autorotation landing capability of current and future Army helicopters shall be established. An analytical investigation will then be conducted to delineate the sensitive parameters and limits that affect the quality of the autorotative entry and landing of helicopters.

The modification of an existing analytical method shall be performed resulting in an efficient and economical computerized mathematical model for the evaluation of the autorotative capability of current and advanced helicopter systems. Through the previously modified computer evaluation technique, sensitive or limiting parameters affecting AH-1G, UH-1D, OH-6A, and OH-58A helicopter autorotation entry and landing capabilitiies will be determined with baseline aircraft results compared with flight test data. In addition, an autorotation landing index based on energy and time factors shall be computed and catalogued for the subject baseline helicopters.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0012, SUBSYSTEM STATUS MONITOR

H. Harper, Sikorsky Aircraft Co., Division of United Technology Corp, *N. Main St., Stratford, Connecticut* 06602 (DA0E3850; DAAK51 78 C 0023)

To determine the technical feasibility and application practicality of a central information processing and crew advisory system for advanced Army helicopter applications. The system will use on-board computer technology to interrogate the subsystems, analyze data collected, and provide advisories to the crew on a multifunction cockpit instrument.

The approach involves five tasks: a. Parameter identification and analysis, b. Define information handling format, c. Define hardware/software, d. Evaluate effectiveness, e. Identify peripheral functions.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0013, AIRCRAFT/STORES COMPATIBILITY

M. Charles, U.S. Dept. of Defense, Air Force, Armament Lab., *Eglin Air Force Base, Florida* 32542 (DF631660)

Air Force function - support of store separation analysis and advanced conventional weapons. Deficiency or opportunity - the major areas to be addressed by this work unit are: analytical prediction of aerodynamic forces under transonic conditions and to prevent exceeding the qualification temperatures of weapon components due to aerodynamic heating. Objective - conduct basic research in the areas of transonic aerodynamics and aerodynamic heating to provide a technological base for use by weapon developers. How work contributes - this work will allow for an improved technological base for design of advanced conventional weapons and a decrease in the cost of determining store/aircraft compatibility.

Transonic aerodynamics: conduct studies and theoretical investigation to identify the state-of-the-art of transonic aerodynamics and store separation analysis. Wind-tunnel tests will be conducted to verify the analytical techniques identified through the state-of-the-art investigations. Aerodynamic heating: in order to understand how heat is transferred between objects in contact, basic research will be done in the area of contact thermal conductance. This research will be done at Louisiana State University (LSU) using AFATL-furnished equipment already purchased under this program.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Armament Lab.

1.0014, AIRBORNE FERROGRAPH DEVELOPMENT

E.R. Bowen, Foxboro Transsonics Inc., *Burlington, Massachusetts* 01803 (DN796802; N00140-76-C-0713)

The principle objective is to develop and fabricate for evaluation engine-mounted sensors to detect impending oil-wetted parts failures in gas turbine engines. This contract will determine the best method of measuring the wear debris deposited by the magnetic precipitation technique. The candidate approaches are: resistive, inductive, capacitive and optical. The goal is to detect 95% of bearing or gear failures in sufficient time to avoid catastrophic failure or secondary damage. The technical effort is based on previous development contract numbers N00140-72-C-6082 and N00140-73-C-1065.

The initial eighteen months of this effort consists of final system design, with particular consideration given to reducing weight and size, and prototype fabrication and delivery. This prototype unit will be evaluated at NAPC to verify operating characteristics on a gas turbine engine. If the evaluation reveals a need for minor redesign, a three-month redesign, reevaluation period is provided. Upon satisfactory completion of the evaluation, the Navy has the option to authorize go-ahead for fabrication of five additional units. Lack of funding presently precludes exercising this option.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Propulsion Test Center

1.0015, EJECTION SEAT TWO-AXIS FLUIDIC THRUST VECTORING SYSTEM

R.B. Beale, Honeywell Inc., *2600 Ridgeway Parkway N.E., Minneapolis, Minnesota* 55413 (DF136860; F33615-76-C-3070)

Aerodynamic and/or rocket thrust line-center of gravity misalignment can result in ejection seat instability leading to reduced trajectory height, unacceptable loads on the crewmember, and possible recovery parachute entanglement. The objective of this effort is to experimentally validate a selected fluidic thrust vectoring system concept which will be identified by a current AFFDL effort. A system which increases the stability of the ejection seat during the critical rocket burn portion of the trajectory will result in lower major injury and fatality rates for USAF ejection seat escape systems.

The preliminary design of a two axis fluidic thrust vectoring system which will result from a current AFFDL effort will be utilized as the starting point of this effort. Experimental validation of the fluidic/mechanical components as well as the complete subsystem will be performed utilizing conventional cold gas techniques. An analytical performance evaluation of a fluidically stabilized ejection seat will be conducted concurrently with the experimental validation effort.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0016, PROPAGATION TECHNIQUES

P.S. Demko, U.S. Dept. of Defense, Army, Aviation Research & Development Command, Management Systems Div., *Fort Monmouth, Red Bank, New Jersey* 07703 (DA0C3430)

To determine MLS siting restrictions and performance limitations with respect to beam clearance over terrain and reflections from obstacles typically found in Army landing sites to determine optimum polarization, frequency and siting criteria.

Results from a joint Army/Air Force polarization/multipath field measurement/test program at three active military airfields (Cairns AAF, Ft Rucker, Al, Wright Patterson AFB, OH, and Felder AAF, Ft Eustis, VA) will be analyzed and a final report of work and analysis performed will be published for unlimited distribution to the international MLS user community. Editors and authors of this report will aid the user community in interpreting reflectometry data of specific interest and applying results and analysis to specific MLS multipath scenarios. Computer algorithms and operational programs, developed through the joint Army/Air Force program, for reduction of polarization/multipath data and simulation of the multipath signatures of MLS landing sites will be exercised and validated. The validated algorithms and data base will be used to research specific customer MLS multipath problems and establish MLS siting criteria.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Avionics Research & Development Activity

1.0017, AIDS AIRCRAFT INTEGRATION (F-14)

C. Dowd, Grumman Corp., Aerospace Corporation, *S. Oyster Bay Rd., Bethpage, New York* 11714 (DN881142; N62269-77-C-0188)

To provide inputs to aid in the development of the AIDS (advanced integrated display system). The AIDS program objective is to develop a totally new concept in modular cockpit instrumentation for naval air missions under all operational conditions,

accomodating all aircraft sensors, and satisfying 1980 era requirements for dependability and supportability. This contract supports work unit ZA601, Agency Accession No. DN681080.

The contractor will examine the AIDS concepts in relation to a particular existing aircraft (F-14) manufactured by Grumman and project this evaluation to a future tactical aircraft such as is envisioned by Grumman.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

1.0018, HIGH-SPEED INLET DEVELOPMENT FOR FLIGHT EVALUATION

A.H. Cornish, Centro Corp., *1934 Stanley Ave., Dayton, Ohio* 45404 (DF142290; F33615-75-D-0017)

This work unit is designed to support the effort to develop improved high-speed aircraft. One problem area which exists is the need for an efficient air induction system to operate in the high speed regime. The goal of this program is to develop the technology necessary to build such an air induction system. Specifically this work unit is designed to modify an existing high-speed inlet model to be used for FY77 testing.

The existing model is to be modified by installing glass sidewalls to aid in flow visualization and additional pressure instrumentation will be installed to further aid in flow analysis.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0019, NI76XB HIGH-PRESSURE TURBINE (HPT) BLADES FOR ADVANCED ENGINE APPLICATION

E. Kerciznik, General Electric Co., Aircraft Engine Group, *1 Jimson Rd., Cincinnati, Ohio* 45215 (DN696803; N00140-75-C-0355)

To operate advanced D.S. superalloy high-pressure turbine blades in an advanced military engine at bulk metal temperatures 60 F higher than is currently possible with the best conventional D.S. Superalloys such as MAR-M-247 (HF) and MAR-M-200 (HF) and to achieve a 300-hour level of blade durability at this temperature.

The program is organized as follows: Phase I - manufacture trial blades in order to define casting parameters for blade manufacture - 6 months. Phase II - make engine quality blades. Cast two blade sets plus spares but machine only one set for subsequent engine tests - 11 months. Phase III - engine assembly and test - 9 months.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Propulsion Test Center

1.0020, AIRBORNE MEASUREMENT OF LIGHTNING ENVIRONMENT AND STUDIES OF INDUCED EFFECTS IN AIRCRAFT

R.K. Baum, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF140270)

Obtain airborne electric and magnetic field measurements of the nearby lightning environment to characterize the threat, obtain measurements of skin currents and induced transients within the aircraft while operating in a lightning environment, obtain a correlation between airborne and ground lightning test measurements, and obtain and apply a computer program model of the lightning-aircraft interaction sufficient to predict induced transients on subsystems, and validate results by comparison with measured data. Newer Air Force aircraft are using electronic subsystems that are increasingly vulnerable to lightning induced transients.

A NASA Learjet aircraft will be instrumented to measure the external magnetic and electric field environment due to lightning as well as internal induced transients. The aircraft will be flown as part of the Thunderstorm Research International Program (TRIP) hosted by Kennedy Space Center during Jul and Aug 77 in the vicinity of the thunderstorms and lightning to gather data. A ground simulated lightning test will then be performed on the instrumented aircraft, and all the observations will be correlated with those made under actual lightning conditions. A computer program chosen from among existing EMP simulation models will be adapted to model the aircraft-lightning interaction for this case, data obtained during the airborne and ground test phases will be used to validate and assist in the generation of the computer algorithm.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0021, FLIGHT PERFORMANCE ANALYSIS AND DESIGN METHODS

D.T. Johnson, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF136190)

In the design or evaluation of military flight vehicles performance analysis is the key item in the overall assessment. Currently methods are lacking in speed of application or are technically deficient for certain vehicle applications. To upgrade our capability, reduce costs associated with concept evaluations, this effort will provide a comprehensive performance and trajectory analysis package. The emphasis of this effort will be on the reduction of resources required to conduct performance analysis.

A fundamental library of performance programs currently exist which will be the basis of the effort. Such items as common input data, plotting will be added to existing programs, in other cases analysis will be conducted to develop small rapidly running programs. Modifications will also be made to assure rapid convergence on the solution.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0022, ATMOSPHERIC ELECTRICAL HAZARDS TO AIRCRAFT

V.L. Mangold, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF141930)

More sophisticated electronic systems and advanced structural materials are being used in USAF aircraft, which will require hardening to the natural atmospheric electricity hazards (AEH) environment. Research is required to evaluate the susceptibility of these systems and materials. This effort will provide a data base to be used for the evaluation of the susceptibility of aircraft to the deleterious effects of the AEH environment and provide the technology for evaluating and hardening these systems and materials to this natural environmental threat. The data generated from this work effort will be used by the Air Force to define the natural AEH environmental threat, to provide the basis for development of test techniques and facility designs for assessing aircraft systems and materials to the AEH environment, and to assist in the development of design guides for hardening aircraft systems and materials to the AEH enviromental threat.

The approach will be to conduct flight programs to measure and define the natural AEH environment and its effects on electronic systems. Ground test facilities will be developed and experimental test techniques to simulate and assess the susceptibility of aircraft systems to the AEH envionment will be developed, refined and validated. The data generated from these programs will be documented in the form of guides describing the characteristics of the natural AEH environment, specifications for test techniques and simulation facilities, and inputs into design guides for hardening aircraft systems to the natural AEH environment.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0023, DEVELOPMENT OF HEATED AIRFRAME DESIGN CRITERIA FOR STRATEGIC AND TACTICAL AIRCRAFT

D.B. Paul, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF129190)

Strategic and tactical aircraft with supersonic to hypersonic speed capability need detailed design requirements in military specifications and adequate airframe load prediction techniques to account for the effects of aerodynamic heating upon flight vehicle airframes. Current military specifications (MIL-A-8860 series) do not delineate adequate requirements for airframe design under aerodynamic heating, and the AFSC design hand-

books do not outline proper procedures to structurally account for heating effects. This effort will develop essential heated airframe design criteria and the associated load prediction techniques to account for the structural effects of aerodynamic heating on military aircraft.

Develop and refine in-house heated structure analysis techniques with emphasis on advanced heated airframes, but with possible application to other heated structures (such as radomes and propulsion systems). Establish, where necessary, computer programs to aid structural design engineers. Implement, where applicable, proven techniques into the AFSC design handbooks and the USAF structural design criteria specifications.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0024, AIRCRAFT FORCE MANAGEMENT METHODS

L.E. Clay, University of Dayton, Graduate School, *300 College Park Ave., Dayton, Ohio* 45469 (DF140570; F33615-77-C-3122)

MIL-STD-1530 requires airframe contractors to provide USAF with a force management data package which includes the procedures and techniques necessary to maintain aircraft structural integrity. To date, the elements involved in managing a force of aircraft to protect structural integrity have not been adequately developed. This procurement will support MIL-STD-1530 by developing the necessary force management methodology, including individual aircraft tracking, operational usage monitoring, and maintenance forecasting. The results of this program will be used to establish efficient force management techniques and procedures, thereby reducing costs and maintaining structural integrity of USAF aircraft systems.

This effort will include the development of methodologies for the various elements involved in force management. Necessary complexity and duration will be determined for usage monitoring programs to be used for developing baseline operational spectra and detecting significant changes in usage. Individual aircraft tracking techniques will be developed which are realistic compromises between ideal tracking programs and economic/logistic constraints. Optimum procedures for forecasting maintenance actions will be established.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0025, DESIGN OF SELECTED CONCEPTS - CH-47 TERRAIN FLYING WITH EXTERNAL LOADS

J. Davis, Boeing Co., Vertol Division, *P.O. Box 16858, Philadelphia, Pennsylvania* 19142 (DA0E3793; DAAJ02-77-C-0069)

To improve the capability of helicopters to conform to terrain flying requirements while engaged in delivering supplies/equipment in forward areas under high level air defense threat environments.

A preliminary design of the load snubbing system concept will be formulated and subjected to analysis to define system size, performance, aircraft interactions, schedules and cost data.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Lab.

1.0026, FLOTATION FOR AIRCRAFT, TECHNOLOGY (FLOAT) INVESTIGATION

W.M. Weisemann, U.S. Dept. of Defense, Navy, Naval Air Development Center, Air Vehicle Technology Dept., *Warminster, Pennsylvania* 18974 (DN881113)

The general objective is to provide an automatic flotation system for Navy aircraft. Such system will be carried on-board during peacetime operations and shall prevent an aircraft and its attached missiles from sinking to the bottom of the ocean following ditching or inadvertent loss from ship decks. The specific objective of this task is to determine optimum location, mechanization techniques and operational implications for such system. The advantage to the Navy would be rapid, low-cost recovery of politically sensitive aircraft and warheads. A secondary advantage may be realized by reconditioning recovered high-cost airframe and equipment components of new aircraft. This effort is supported by work unit DH819B.

A contract, using the F-14 as the investigation baseline, will be awarded. NavAirDevCen will define general milestones to be followed. After a final, recommended flotation configuration has been defined, a kit-type demonstration system shall be developed, verified in the laboratory for adequacy and tested for flotation capability with a surplus airframe. This concept shall be directed toward minimum aircraft modification, weight and effect on primary mission capability. The concept will be aimed at usage on several aircraft types.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0027, PRELIMINARY AIRBORNE TESTING OF A G PROTECTIVE SUPINE SYSTEM (PALE)

J. Harding, U.S. Dept. of Defense, Navy, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate, *Warminster, Pennsylvania* 18974 (DN881678)

To assess in airborne environments the adequacy of the g protective PALE (pelvis and legs elevating) system which protects aircrew against high in-flight accelerations by transforming gz loads into better tolerable gx loads. This effort is part of the problem area mechanical force environment as listed under priority a code PA J title Better Methods to Increase G Tolerance of the Charleston Report pg 109 1973 (FY74 Naval Aviation Biomedicine Human Effectiveness Report).

A seat system which supports the experimental pilot in the PALE position will be manufactured and integrated in the third pilot station in the cargo compartment of the CH 53. The seat back will be at an angle of 65 degrees from the vertical and will allow for control of rudders and modified stick. Takeoff and landing will be made routinely by the pilot in the cockpit. Once airborne he will relinquish the command for gradually increasing time periods to the experimental (third) pilot provided that flying conditions are smooth and safe. The experimental pilot's capability to control the AC in the PALE position will be evaluated. It is understood that the test vehicle is incapable of producing significant in-flight accelerations. The remarkable g protective qualities of the PALE system however have been previously demonstrated in three series of NavAirDevCen centrifuge experiments; thus it is the rationale of this study to show how much (if any) the PALE position affects man's capability to control an aircraft in actual flight. Phase B (not funded at present) in a dual-control air vehicle which is capable to produce high in-flight accelerations a PALE seat dystem of the type used in the aforementioned centrifuge experiments (PALE 15) will be integrated and provided with side arm controls. Similar to Phase A the experimental pilot's performance and safety aspects will be evaluated and compared with previous experiments on the NaVairDevCen centrifuge.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

1.0028, OMEGA PERFORMANCE DATA ACQUISITION

Unknown, Capitol International Airways, *Smyrna, Tennessee* 37167 (FA78NA-AP-17; FA161589 (TRAIS NO.))

This is an agreement between FAA, NAFEC and Capitol International Airways, Inc. permitting the FAA to obtain Omega performance data from three Capitol aircraft flying commercial air routes around the world by use of Government furnished recorders modification kits. FAA will provide all the equipment necessary so that Capitol International Airways can adequately collect the needed information to perform the tasks outlined in this agreement.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

1.0029, ADVANCED TECHNOLOGY WING STRUCTURAL COMPONENT

H.E. Reynolds, L T V Aerospace Corp., Vought Aeronautics Division, *P.O. Box 5907, Dallas, Texas* 75222 (DF138220; F33615-76-C-3138)

Increasing acquisition and life-cycle costs of aircraft have focused attention on the development and demonstration of new airframe structures technology which will provide reduced

ownership cost while improving structural durability and vehicle performance. The objective of this effort is to demonstrate feasibility of selected low-cost advanced wing box structural concepts applicable to future tactical and strategic aircraft. Design concepts will consider use of both metallic and composite materials coupled with innovative design approaches. Program results will provide candidate technology and hardware demonstrated structural alternatives for advanced development and future systems application.

Structural wing box components representing a 10-ft. inboard section of a variable camber supercritical wing configuration will be designed, fabricated, and tested to show concept feasibility. Acquistion, maintenance, and repair cost comparisons will be generated against conventional machined aluminum wing box structure.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0030, AIRCRAFT EQUIPMENT VIBRATION PREDICTION

J.A. Poindexter, Vought Corp., Advanced Tech Center Inc, *P.O. Box 5907, Dallas, Texas* 75222 (DF141480; F33615-78-C-3411)

The currently available methods for the formulation of vibration test criteria do not realistically predict the level and spectrum of vibration encountered during flight maneuvers by onboard equipment carried in modern high-performance aircraft. Equipment that is evaluated using the existing criteria are not adequately tested for these violent conditions resulting in excessive vibration-induced equipment field failures. This effort is to analyze already measured vibration data on the A-7 aircraft while it underwent violent flight maneuvers. This data along with data taken on F-14, F-15, etc., aircraft will form a data base from which the required test criteria will be formulated.

Analyze the already taken flight vibration data. Correlate vibration levels and spectra with aircraft flight conditions and transducer locations. Perform transfer function analysis between transducers. Document all analyses in a data report.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0031, RPV PROPELLER NOISE REDUCTION STUDY

R.P. White, Systems Research Lab. Inc., R A S A Division, *1055 J. Clyde Morris Blvd., Newport News, Virginia* 23602 (DA0D4109; DAAJ02-77-C-0029)

The technical objective is to evaluate and establish low-noise features for design of small-size low acoustically detectable propellers applicable to conceptual remotely piloted vehicle (RPV) aircraft.

This investigation will review past and present efforts covering the acoustic aspects of small-scale propellers. Ten propellers and two shrouds will be designed and fabricated to accommodate a 220-lb. RPV aircraft. Aural detectability shall be the design driver in selecting various planforms, shapes and blade numbers. The propellers and shrouds will undergo both static and dynamic tests in both tractor and pusher configurations. Performance and aural detectability will be closely investigated to provide guidance and trade-off data for design of low-noise RPV propellers.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0032, WIND-TUNNEL EVALUATION OF AN AEROELASTICALLY CONFORMABLE ROTOR

R.P. White, Systems Research Lab. Inc., R A S A Division, *1055 J. Clyde Morris Blvd., Newport News, Virginia* 23602 (DA0E3777; DAAJ02-77-C-0046)

Investigate the ability to improve rotor operational qualities (i.e., performance, efficiency, loads, stability and handling qualities) by deliberately designing aeroelastic properties to exploit the inherent tendency for blades to deform elastically. Determine if significant practical improvement can be made in rotor operational qualities reliability and maintainability, and cost. This effort will be directed toward generation of advanced data pertinent to advanced Army aircraft, including UTTAS, AAH, and ASH.

Conduct thorough review of effects of aeroelastic properties on rotor operational qualities. Select specific significant parameters and objectives which can be evaluated with existing technological capability. Perform rigorous phenomenological studies of the results of parameter variations using advanced analytical tools. Design and fabricate wind-tunnel models, and perform comprehensive tests to substantiate analytical findings. Carefully review results to determine specific parametric trends for improving rotor design. Where practical, interpret trends in terms of full-scale design characteristics which may be applied in aircraft development.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Air Mobility Research & Development Lab.

1.0033, HT ST 78-33 - DESIGN AND STRUCTURAL EVALUATION OF AIRFRAME STRUCTURES - ARMY AIRCRAFT

D. Good, U.S. Dept. of Defense, Army, Aviation Research & Development Command, Applied Technology Lab., *Fort Eustis, Newport News, Virginia* 23604 (DA0E3818)

Task I - to develop advanced composite airframe structural design concepts/configurations to support future Army aircraft. The structural concepts and configurations developed will provide improved weight, structural integrity, and producibility characteristics over an all-metallic structure. Task II - to determine the applicability of 'tetra-core' as a structural configuration for Army helicopters structures (tailboom).

Task I - select a baseline aircraft and establish a detail description of the baseline metal cabin structure. Establish design criteria for composite materials applications. Develop preliminary design concepts/configurations for composite cabin structures and conduct a trade-off analysis considering structural integrity, weight, material applications, and producibility to determine the more promising advanced composite structures. Task II - develop/establish the analytical and fabrication capability for application of tetra-core to the AF-1G helicopter tailboom. Establish design criteria, cost, weight and 23mm ballistic damage tolerance characteristics.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Lab.

1.0034, HT ST 75-30 - IMPACT BEHAVIOR COMPOSITES - ARMY HELICOPTERS

Unknown, U.S. Dept. of Defense, Army, Aviation Research & Development Command, Applied Technology Lab., *Fort Eustis, Newport News, Virginia* 23604 (DA0E3832)

Determine the differences in nonlinear load deflection characteristics between a substructure fabricated with aluminum and the same substructure fabricated with composite materials. The feasibility of applying the analytical and testing techniques used in USAAMRDL TR 74-12 to similar structures fabricated with composites will be investigated.

Phase I - the analytical and testing techniques used in USAAMRDL TR 74-12 will be reviewed. The technical feasibility of performing scale-model tests of the candidate designs will be investigated by analyzing and statically testing and impact testing a one-half scale model of the test specimen of USAAMRDL TR 74-12. Phase II - the Phase I substructure will be redesigned using composite materials. Each of the composite substructure designs will undergo stress analysis, static testing, drop impact testing, and post-test analysis.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0035, AIRCRAFT DESIGN - TRANSONIC AREA RULE

M. Hafez, Flow Industires Inc., Flow Industries Co., *21414 68th Ave. S., Kent, Washington* 98031 (DN675530; N00014-76-C-0880)

The recently developed transonic area rule with lift is becoming an extremely important tool for the design of aircraft configu-

rations. The proposed investigation will explore, theoretically, the range of validity of the area rule in terms of such parameters as: Mach number, angle of attack, thickness ratio and the sweep for representative aircraft configurations.

The power of the area rule for design is that it masks out details which, in an asymptotic sense, do not contribute significantly to the structure of the transonic flow field. The theory provides, relatively simply, the global characteristics of the configuration. In order to assess the range of validity of the theory as non-asymptotic deviations become more pronounced, more exact numerical calculations will be made for a range of configuration parameter and compared with the area rule predictions.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

1.0036, RESEARCH IN ADVANCE FLIGHT CONTROL DESIGN

I.M. Horowitz, Weizmann Inst. of Science, *P.O. Box 26, Rehovot, Israel* (DF141040; AFOSR-77-3355)

This work unit will support the enhancement of advanced aerospace vehicles. This work unit will address the design of flight control systems with significant uncertainty and exacting performance requirements. The objective of the study is to explore the application of flight control of a precise synthesis technique recently developed for nonlinear plants. This work will develop techniques which will guarantee the response of an aircraft to be within its specified bounds over a specified range of parameter uncertainty.

This research project will intensively continue previous research, in order to determine the optimum practical exploitation of unconventional linear digital compensation which is multiple-faced in realistic control problems, and to develop practical design techniques for such exploitation. This research project will also apply the nonlinear design technique to possibly the F-4 longitudinal axis control and maybe later to a three axes flight control system.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

ASTRONAUTICS

Includes Astronautics (general); Astrodynamics; Ground Support Systems and Facilities (space); Launch Vehicles and Space Vehicles; Space Transportation; Spacecraft Communications; Command and Tracking; Spacecraft Design, Testing, and Performance; Spacecraft Instrumentation; and Spacecraft Propulsion and Power. For Related Information See Also Aeronautics.

2.0001, SATELLITE DISINTEGRATION DYNAMICS

B. Kaufman, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN680433)

The purpose of this effort is to analyze foreign and domestic satellite explosions and their possible causes; to investigate satellite debris collision probabilities; the application of decoy strategies and counter-strategies and the stability analysis of satellite constellations, applications to satellite defense and A-SAT applications.

The particle ensemble will be modeled as a continuum of particles in phase space which emanates from a point source with a distribution of momenta. This model will be used to study the evolution of the ensemble when the momentum distribution is known; to solve the inverse problem of deducting the initial momentum distribution from subsequent observation of the ensemble, to study the effects of a point source acting over a finite interval of time; and to determine the asymptotic distribution of the particles as the time since initial dispersion becomes very large.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, CONDUCTIVITY AND CHARGE STORAGE PROPERTIES OF INSULATING MATERIALS

J. Wilkenfeld, International Research & Technology Corp., *P.O. Box 80817, San Diego, California* 92138 (DF903240; F19628-77-C-0245)

Objective - communications satellites (DSCS) have displayed erratic electronic behavior soon after being placed in orbit. It has been determined that at least some of the observed malfunctions could be due to electrical breakdown in insulating materials caused by charge accumulation from electrons present in the region of the satellite orbits. The objective of this work is to provide information on the electrical conductivity and charge storage properties of insulating materials now used or proposed for use on satellite surfaces. This information will make possible improved satellite designs that minimize malfunctions due to charge buildup.

The electrical conductivity of insulators is a major factor in determining the amount of charge they can accumulate. The environment in which an insulator is located can have a significant effect on its conductivity. The conductivities of the insulators to be tested will therefore be measured under conditions simulating as closely as possible the synchronous orbit space environment. Surface conductivity, on which there is very little information available, will be measured as well as bulk conductivity. The insulators will also be irradiated with electrons simulating those encountered in space to determine the charge storage properties. These charge storage properties will be correlated with the conductivity measurement to enable selection of insulating materials that will minimize charge buildup and subsequent electrical breakdown.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

3.0002, IMPACT DAMAGE TOLERANCE OF THICK GRAPHITE/EPOXY LAMINATES

N.M. Bhatia, Northrop Corp., Aircraft Div, *3901 W. Broadway, Hawthorne, California* 90250 (DN881355; N62269-77-C-0401)

Aircraft structures are exposed to impact threats such as accidentally dropped tools, runway stones, and hail. In order to take full advantage of advanced composite materials in present and future Navy flight structures by a) allowing high-strain designs, b) insuring structural integrity of current designs through determination of critical damage and c) establishing proper inspection intervals, the impact resistance and post impact damage tolerance of composites must be fully assessed. This contract supports work unit DG 602, Agency Accession No. DN 133126.

Conduct experiments to assess vulnerability of thick GR/EP laminates to low-velocity, hard-object impact and determine post impact compressive fatigue strength.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

3.0003, THEORETICAL AND EXPERIMENTAL ANALYSIS OF ALKALINE ZINC BATTERIES

D.N. Bennion, University of California, Los Angeles Campus, School of Engineering & Applied Science, Dept. of Energy & Kinetics, *405 Hilgard Ave., Los Angeles, California* 90024 (DF043860; F44620-76-C-0098)

AF function - communications, flight operations, and aircraft subsystems depend on auxiliary battery sources for power. Deficiency -longer life, lighter weight, and higher energy-density batteries are needed to meet Air Force requirements. Objective - results from this research will assist in the prediction and measurement of current density distributions, concentration distributions and their relationship to electrode design, convective flow related to membrane separator properties, and gassing of the electrodes. How work contributes - the goal of battery modeling techniques is to relate a battery's physical characteristics to its performance in service. Such a capability allows battery users to select or design a battery to specific performance requirements. The enhanced understanding will provide the battery developer with new approaches to the improvement of battery components.

To describe theoretically the current distribution in a zinc-nickel oxide (or silver oxide) electrochemical energy storage cell

and to compare the predictions with actual experiments. Emphasis will be given to prediction and measuring current distribution and concentration distributions, and to determine their relation to cell potential, potential distribution, electrode structure, and other geometric and operating characteristics. Priority will be given to studying the nickel oxide electrode and to elucidating the causes of the failure of the zinc electrode. The effect of an inert conducting matrix in the zinc electrode will be considered.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0004, FLIGHT ATTENDANT UNIFORM FLAMMABILITY

J.H. Winger, U.S. Dept. of Commerce, National Bureau of Standards, *Washington, District of Columbia* 20228 (4922378)

PROJECT OBJECTIVE: Provide technical support to FAA in the establishment of flammability regulators for flight attendant uniforms.

PROJECT APPROACH: Evaluate potentially commercial fabrics in the FAA tests. Relate fabric performance to in-use requirements. Recommend appropriate criteria. Analyze comments on the FAA federal registers notice. Evaluate and recommend modifications as necessary.

SUPPORTED BY U.S. Dept. of Commerce, National Bureau of Standards

3.0005, SURFACE ALLOYING OF BEARING AND GEAR STEELS BY ION IMPLANTATION

J.K. Hirvonon, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN889788)

To improve bearing and gear corrosion resistance and reliability through surface alloying by ion implantation.

By the use of corrosion testing, electrochemical potential measurements and bearing and gear simulated bench testing, ion species and concentrations will be optimized on currently used M50 bearing steel. After optimization full-scale bearing life testing, engine testing and field evaluation testing will be conducted. A parallel effort will be conducted on implanting advanced bearing and gear materials for corrosion resistance followed by specimen and full-scale testing.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Propulsion Test Center

3.0006, FLOW AND FRACTURE PROCESSES IN POWDER METALLURGICAL NICKEL-BASE SUPERALLOYS

M.J. Blackburn, United Technologies Corp., Pratt & Whitney Aircraft Div, *P.O. Box 2691, West Palm Beach, Florida* 33402 (DF047550; F49620-77-C-0083)

AF function - nickel-base superalloys, because of their unique high-temperature properties, find extensive application in the turbine section of gas turbine engines. Opportunity - as the performance requirements of such aerospace power plants become more demanding, the material properties must be improved to compensate for the more severe operating conditions. However, the specific property improvements required in an alloy depend upon the component for which it is to be used. For the airfoil section of a blade, high-temperature creep and rupture properties coupled with good thermal fatigue resistance are critical properties. For a turbine disk, which operates at lower temperature, improved engine performance translates into requirements for higher strength materials with superior stress rupture characteristics. Objective - this research will obtain insight into the factors and mechanisms that control the strength and stress-rupture properties of powder metallurgy nickel-base superalloy disks fabricated by hot isostatic pressing. How work contributes - as such, it will contribute to AF programs to exploit advanced cost-effective manufacturing methods (hot isostatic pressing of nickel alloy powders) for the production of critical engine components.

Two basic mechanical properties of nickel-base superalloys fabricated by powder metallurgy techniques have been selected for study - stress rupture, and strength with emphasis on the yield stress. Several alloy compositions, including MERL-76, will be selected for detailed mechanical and microstructural characterization. Quantitative models will be constructed of the mechanical processes, and related to experimental observations.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0007, STUDY OF INTERMETALLIC COMPOUNDS

J. Miller, United Technologies Corp., *P.O. Box 2691, West Palm Beach, Florida* 33402 (DF680850; F33615-75-C-1166)

The objective of this program is to determine the suitability and potential of titanium aluminum (TiAl) base materials for use in aircraft turbine engines. It is of specific importance to study the response of this material, as an example of a class of materials, to the stresses, strains, and environment found in a gas turbine engine.

The program shall consist of the selection, preparation, processing, and characterization of a suitable composition based on the intermetallic compound TiAl. At the same time the manufacturing process steps necessary to produce turbine blades shall be explored and assessed. If it is determined that the necessary techniques are available, a partial set of turbine blades may be fabricated using an existing design. These blades shall be bench- and rig-tested and, if suitable, may be made available for later engine testing.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Materials Lab.

3.0008, EFFECTS OF ELECTRONIC EXCITATION STRUCTURE ON THE OPTICAL PROPERTIES AND ELECTRON EMISSION OF VARIOUS MATERIALS

M.W. Ribarsky, Georgia Inst. of Technology, Graduate School, *225 North Ave. N.W., Atlanta, Georgia* 30332 (DF045830; AFOSR-76-3108)

AF function - this proposed research primarily falls in the 2.1 and 2.2 research objectives which deal with basic research to identify approaches leading to the formation of new titanium alloy systems capable of sustained operation at temperatures up to 1600 degrees F. Also predictability of the effect of corrosion on the load-bearing capability of structure requires fundamental knowledge of chemical, electrochemical, mechanical and metallurgical influences, and their interaction. Further research is needed to understand and prevent degradation of a broad range of materials exposed to oxidizing environments at elevated temperatures. Deficiency - potential future high-performance Air Force aircraft are forecasted to be operating at higher dynamic pressures and temperatures. Continued use of aluminum alloys to fulfill future objectives remains an attractive economical approach, however, alloy systems of titanium, steels and superalloys which feature improved resistance to repeated high stress at high temperatures are needed. Objective - to study the electronic excitation structure of the transition metals and their compounds. The study will include the effects of correlation of the excited electron with the surrounding medium, relaxation of the electrons around the hole left by the excitation, and the interaction of the excited electron with its hole. Contribution - this research is a part of a comprehensive program in the study of the many body excited states.

An investigation of the electronic excitation structure of the transition metals and their compounds will be carried out which will include the effects of correlation of the excited electron with the surrounding medium, relaxation of the electrons around the hole left by the excitation, and the interaction of the excited electron with its hole. Recent theoretical and experimental work has shown that all these effects must be included in order to obtain a detailed understanding of the excitation structure, optical properties, lattice dynamics and dielectric response of many materials, especially the transition metals. Calculations will be performed on titanium oxide, nickel oxide and lithium.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0009, SPECTROSCOPIC DETERMINATION OF INTERMOLECULAR POTENTIALS OF GAS LASER COMPONENTS AND OF MAJOR ATMOSPHERIC CONSTITUENTS

W. Klemperer, Harvard University, Cambridge Campus, School of Arts & Sciences, Dept. of Chemistry, *Cambridge Station, Cambridge, Massachusetts* 02138 (DF048100; AFOSR-77-3269)

AF function - communications, surveillance, detection systems, weaponry for airborne applications. Deficiency - the characterization of collisional processes leading to the excitation and deactivation of internal degrees of freedom in laser and atmospheric molecules is incompletely established. Objective - this research program is concerned with the determination of intermolecular pair potentials by the measurement of the rotational spectra of loosely bound complexes. How work contributes - a detailed knowledge of the intermolecular potential of laser gases such as Hf with a variety of molecules should be of value in obtaining a fundamental understanding of the collisional behavior of Hf. This provides an understanding of its vibrational relaxation to facilitate laser design.

The spectroscopy of the complexes uses molecular beam sources with supersonic nozzles for their preparation and mass spectrometers for species identification. The spectroscopy involves rotational transitions for a fixed vibrational state which provides properties of the intermolecular potential in the region of classically allowed motion. The determination of the intermolecular potential for a system from the observed data involves solution of the Schroedinger equation for the weak bond degrees of freedom. A parameterized potential is introduced, the Schroedinger equation solved, and parameters are adjusted to produce the best agreement with spectroscopic constants.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0010, USE OF CERAMICS IN AIRCRAFT ENGINE BEARINGS

M.L. Torti, Norton Co., *1 New Bond St., Worchester, Massachusetts* 01606 (DN890106; N00019-77-C-0551)

The objective of this procurement is to investigate the utility of ceramics as a means of increasing performance capabilities, service life or environmental resistance of rolling element bearings for use in turbine engines.

The load life relationships of steel on ceramics and ceramics on ceramics will be evaluated in rolling contact fatigue tests. Aircraft quality precision rolling element bearings with ceramic races and rollers will be designed, fabricated and tested. Silicon nitride and/or silicon carbide are the materials of primary interest.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

3.0011, FUNDAMENTAL STUDIES OF BETA PHASE DECOMPOSITION MODES IN TITANIUM ALLOYS

H.I. Aaronson, Michigan Technological University, School of Engineering, Dept. of Metallurgical Engineering, *Houghton, Michigan* 49931 (DF053680; AFOSR-78-3728)

AF function - a rational basis for materials development is required to assure the availability and effective utilization of structural materials in future Air Force systems. Opportunity - the fundamental methodology to provide comprehensive and systematic improvement of existing metallic materials and creation of new materials is dependent upon an understanding of the physical metallurgy of alloys. Objective -this research is to establish the crystallography and mechanism of bainitic compound precipitation in several Ti-x eutectoid systems and to verify and investigate the massive phase transformation mechanisms in titanium alloys. How work contributes - understanding of this phase transformation is necessary in order to furnish a more substantial base for the development of useful titanium alloys in which these processes play an important role in determining their microstructure and mechanical properties at room and moderately elevated temperatures.

Transmission electron microscopy (TEM) will be used to determine orientation relationships and micro structural features in bainite reaction studies. In addition, a titanium alloy exhibiting a face-centered-cubic to a hexagonal-close-packed transformation will be studied using a combination of TEM and calorimetric analyses to determine the unifying properties of nucleation, growth, and phase transformation crystallography.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0012, PRESSURELESS SINTERING OF SI3N4 METAL OXIDE SOLID SOLUTIONS

T.Y. Tien, University of Michigan, Ann Arbor Campus, School of Engineering, Dept. of Metallurgical & Materials Engineering, *Ann Arbor, Michigan* 48104 (DF044550; AFOSR-76-3078)

AF function - high-performance, economical turbine engines are required for remotely piloted vehicles (RPV) and auxiliary power units (APU). Opportunity - ceramic materials offer great advantages over refractory metals if high-strength, fully-dense components can be mass-produced. Objective - this work seeks to establish the parameters affecting full densification of ceramic materials through a thorough knowledge of the phase equilibria, crystal structure and reaction paths involved. How work contributes - full densification of this material is required in order to maximize strength and minimize corrosive degradation in severe turbine environments.

Thermodynamic phase equilibria will be determined in selected beta silicon nitride-metal oxide systems and applied to the fabrication of articles by the pressureless sintering methods. Various starting materials will be examined in order to take advantage of the most advantageous reaction path.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0013, EFFECT OF REFINING VARIABLES ON THE PROPERTIES AND COMPOSITION OF JP-5

M. Lieberman, Exxon Research & Engineering Co., Government Research Laboratories, *1600 Linden Ave., Linden, New Jersey* 07036 (DN889819; N00140-78-C-1491)

Identify and assess potential future problem areas relative to the properties and composition of both domestic and foreign JP-5 fuels produced from petroleum over the next five to ten years. Emphasis will be placed on current specification fuels but the effects of relaxation of or changes in current specifications will also be studied.

Establish current and future industry representative distribution of crudes, refinery types and locations, and processing schemes used to produce JP-5. Determine any crude/refinery constraints that do or will exist that can limit the quantity or affect the chemical composition of JP-5 fuel. Determine the effect that demand for other fuels could have on the supply of JP-5 fuel. Determine how chemical composition and properties of fuel are influenced by fuel specifications, crude oil types, processing blending, handling and storage. Determine the effects of changes in the chemical composition and properties of fuel on engine or airframe components. Analyze projected changes in JP-5 properties and composition to identify potential future problem areas. Subject most important potential problem areas to detailed analysis.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Propulsion Test Center

3.0014, THE MECHANISM OF FRETTING FATIGUE CRACK INITIATION IN STEELS 12554-MS

D.J. Duquette, Rensselaer Polytechnic Inst., School of Engineering, Dept. of Materials Engineering, *110 8th St., Troy, New York* 12181 (DA0U5576; DAAG29 76 C 0006)

To clarify the basic mechanism underlying the initiation of cracking under fretting-corrosion-fatigue in steels. Fretting and its ramifications in fretting-corrosion-fatigue have been of serious consequence in engine and rotating structural components of Army aircraft and such phenomena may be responsible also for some classes of problems in high rate-of-fire weapons.

Studies will be made of how certain variables such as frequency, microstructure, relative hardness of surfaces, environment, temperature, and contacting surfaces, partake in the process of fatigue initiation in steels. From fretting fatigue studies

conducted at constant strain conditions, quantitative information will be derived which will form the basis of a comprehensive theory for fretting-corrosion-fatigue of metals and alloys.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0015, THEORETICAL INVESTIGATIONS OF THE ELECTRONIC STRUCTURE OF MOLECULES

R.G. Parr, University of North Carolina, Chapel Hill Campus, School of Arts & Sciences, Dept. of Chemistry, *Chapel Hill, North Carolina* 27514 (CHE7722951A01)

Dr. Parr will carry out theoretical studies to solve diverse problems in molecular structure and conformation. Special emphasis will be given to the development of simple models and the development and exploitation of density functional methods, but improvements for both ab initio and semiempirical quantum-mechanical calculation also will be sought. This research represents a continuation of that currently supported by Foundation grant CHE-7504128.

SUPPORTED BY U.S. National Science Foundation, Div. of Chemistry

3.0016, SURFACE ENERGIES AND RELATED PROPERTIES OF BETA-TITANIUM ALLOYS

R. Speiser, Ohio State University, Columbus Campus, School of Engineering, Dept. of Metallurgical Engin, *190 N. Oval Dr., Columbus, Ohio* 43210 (DF040460; AFOSR-75-2799)

AF function - materials having better strength-to-weight ratios, high toughness and improved resistance to corrosion are being sought for aircraft and space vehicles structures. Opportunity - improvement in these properties depends a great deal on the surface and grain boundary energetics of alloys. Objective and how work contributes - this research will obtain surface and grain boundary energy data that will contribute directly to the understanding of the mechanical behavior of a class of alloys, beta-titanium, that is of current Air Force interest for improved airframe structures.

The high-temperature in-situ zero-creep method and grain boundary gro ving technique will be applied to study Ti, Mo, V, and Ti-25 Mo and Ti-50V base alloys. The surface, grain boundary, twinning and stacking fault energies thus derived will aid alloy design to optimize mechanical and environmental resistant properties.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0017, SONIC FATIGUE TESTS OF ADVANCED MATERIALS AND STRUCTURAL CONFIGURATIONS FOR APPLICATION ON MILITARY AIRCRAFT

K.R. Wentz, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF138170)

The development of advanced structural materials has led to concepts applicable to military aircraft, some of which are particularly suitable in areas of high acoustic excitation. The objective of this program is to develop the techniques and methods required to predict the sonic fatigue life of aircraft structures with variations of the following types of joints: weldbonded, bonded joints, and advanced composite designs. Prediction methods are available for the riveted joint, however, improvements are needed in predicting a long service life and to include stiffener design effects into the life-prediction techniques. The objective of this program will also include these improvements to the riveted prediction methods.

The approach is to finish the research work started with the weldbonded and bonded structural joint in which the test work was nearly completed before the closing of the Affdl Sonic Fatigue Facility, 31 Aug 76, to continue the shaker tests of new bonded and weldbonded systems being developed, to initiate a combined analytical and experimental investigation of advance composite design configurations, to develop techniques needed to evaluate random fatigue strain data, to perform an analytical investigation of the stiffener design effects on the sonic fatigue life, and to provide high cycle random fatigue shaker test data. the approach started with the weldbond and bonded joint consisted of a combined analytical and experimental program. Tests were conducted to determine mode shapes, damping, stress response, and sonic fatigue life of 40 weldbonded shaker beams, 20 bonded shaker beams, 16 weldbonded panels, and eight bonded panels. Data from these tests will be incorporated with analytical information into a design guide to predict the sonic fatigue life. A sonic fatigue analysis of the Pabst structure has indicated potential sonic fatigue problems when using heavy gage large bay size bonded structure in a high noise environment. Therefore sonic fatigue test of 14 acoustic panels using the Pabst bond system have been added to this program to provide the fatigue data needed and improve the accuracy of the prediction technique. The development of sonic fatigue design criteria for adhesively bonded aluminum structures has led to certain problems associated with determining the sonic fatigue life of a bonded skin-stringer joint. Eighteen beam coupons will be tested to investigate the effects of the primer. (Text Abridged)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

3.0018, COMBUSTOR EVALUATION OF SPECIAL FUELS

D. Naegeli, Southwest Research Inst., *8500 Culebra Rd., San Antonio, Texas* 78228 (DN789777; N00140-77-C-1345)

Evaluate the combustion characteristics and exhaust emissions of special alternative fuels for aircraft gas turbine engines. This work is in support of work unit DN889793.

Perform tests in a research combustor and a gas turbine engine combustor using diesel fuel marine (DFM), blends of DFM with JP-5, and other alternative fuels. Evaluate combustion performance, flame radiation and exhaust emissions.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Propulsion Test Center

3.0019, THE MOLECULAR STRUCTURE AND BEHAVIOR OF PHOSPHAZENES 14913-C

R.H. Boyd, Utah Higher Education System, University of Utah, School of Engineering, Dept. of Materials Science & Engin, *1400 E. 2nd S., Salt Lake City, Utah* 84112 (DA0F9086; DAAG29-77-G-0197)

Studies in the structural and behavior areas of phosphazenes such as prediction of glass transition temperatures and crystal disordering transitions will be undertaken. Relevance - this research is highly relevant to the performance of polyphosphazenes in numerous areas of Army interest such as in helicopter seals, low-temperature fuel hoses, fire-resistant polymers and fluids, etc.

An improved molecular forcefield for making conformational energy calculations will be developed. Dielectric studies of relaxation processes in crystal disordering transitions will be carried out.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0020, MUTAGENIC POTENTIAL OF PETROLEUM HYDROCARBONS-COMMERCIAL JET FUEL

W. Coate, Hazleton Lab. America Inc., *9200 Leesburg Tpke., Vienna, Virginia* 22180 (PS-4 - HLA(261))

A battery of assays including both in vitro and in vivo applications will be used to determine the mutagenic potential of a reference sample of commercial jet fuel. Assays include the Ames-type Salmonella typhimurium microbial tests, the mouse lymphoma tests, and cytogenetic analysis of rat bone marrow cells. Inhalation will be used as the route of exposure in the in vivo test.

SUPPORTED BY American Petroleum Inst.

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality As-

surance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, PRECISION OPTICAL PATH ALIGNMENT SYSTEM

W.B. Simpson, Boeing Co., Aerospace Division, *220 Wynn Dr., P.O. Box 1470, Huntsville, Alabama* 35807 (DA0F1378; DAAK40 78 C 0037)

Development of a precision optical path alignment system (POPAS) for improving the line-of-sight (LOS) stability of the stabilized mirror airborne laser (SMAL) system.

Apply the error measurement system (EMS) hardware and technology developed under contract DAAK-76-C-0445-10 to effect a reduction in LOS error due to vibration in the SMAL system.

SUPPORTED BY U.S. Dept. of Defense, Missile Research & Development Command, Guidance & Control Directorate

4.0002, SOSTEL/GPMS INTERFACE UNIT

J. Blevins, Sci Systems Inc., *8620 S. Memorial Pkwy., Huntsville, Alabama* 35802 (DN781229; N62269-76-C-0081)

To design and fabricate a SOSTEL III MUX/DEMUX terminal which will be integrated into a SOSTEL/GPMS interface unit and develop necessary software to allow communication between SOSTEL III and other avionics on the GPMS buses. This contract supports work unit ZA601, Agency Accession No. DN681080.

Adapt existing circuit designs to the physical limitations imposed by the configuration of the SOSTEL/GPMS interface unit. Develop electrical interface characteristics. Develop message structure in cooperation with avionics subsystem developers.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

4.0003, ADVANCED RADIAL INFLOW TURBINE INVESTIGATION

C. Linder, Signal Co. Inc., Airesearch Mfg Co, *402 S. 36th St., Phoenix, Arizona* 85034 (DA0P3489; DAAK30 77 C 0093)

The objective of this project is to define and demonstrate the aerodynamic feasibility of utilizing a single stage, radial inflow turbine in an advanced engine for a potential decrease in size, increased simplicity and reduced cost.

The approach will be the design of a single, advanced design radial inflow turbine stage that will replace multiple, axial stages in a single spool gas generator engine and increase cycle efficiency.

SUPPORTED BY U.S. Dept. of Defense, Tank Automotive Research & Development Command, Propulsion Systems Div.

4.0004, ANISOTROPIC AND ELECTRO-OPTICAL EFFECTS IN LIQUID CRYSTALS

J.D. Margerum, Hughes Aircraft Co., *3011 S. Malibu Canyon Rd., Malibu, California* 90265 (DF046390; F49620-77-C-0017)

AF function - the Air Force capabilities in flight operations relies on continuing advances in navigation, guidance, reconnaissance, and surveillance programs. Deficiency - there is a continuing need for new methods, techniques, and devices for the automatic capability in recognizing data patterns and new information. Objective - research is concerned with the chemical and physical structural effects of liquid crystalline components on the related electrooptical properties. How work contributes - results will contribute to the device work on liquid crystals projects on developing flat panel matrix displays for airplane cockpits, electronic reticles for fire control systems and screen projection displays.

The research is directed toward a better understanding of the anisotropic and electrooptical effects in liquid crystals (LC). Studies will be undertaken on the relationship between the flow viscosity of LC mixtures and their conductivity anisotropy, and their dynamic scattering (DS). The effects of chemical structure variation on the birefringence of LC mixture will be investigated, along with the relationship between birefringence of LC mixtures and their DS characteristics.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0005, WAVE INTERACTIONS IN TRANSONIC AND HYPERSONIC FLOW

N.D. Malmuth, Rockwell International Corp., *1049 Camios Dos Rios, Thousand Oaks, California* 91360 (DF042740; F44620-76-C-0044)

AF function - advanced aerospace vehicles. Deficiency - analytical methods are limited in accuracy and range of validity. Objective -better understanding of wave interactions in transonic and hypersonic flow as they pertain to (1) wing body interference, (2) refraction, reflection and diffraction processes occurring in nonlinear wave propagation in steady and unsteady flows, and (3) wind-tunnel wall interference at transonic speeds. How contributes - better understanding of wave interactions will allow engineers to more accurately predict performance of advanced aerospace vehicles and thus eliminate some presently required testing.

An analytical framework will be developed to bridge the gap between numerical and experimental flow models for transonic and hypersonic flows. Specific applications will be selected and analytical formulations developed which can later be tested numerically.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0006, STUDIES IN TRANSONIC FLOWS USING NUMERICAL METHODS

M. Holt, University of California, Berkeley Campus, School of Engineering, Dept. of Mechanical Engineering, *Berkeley, California* 94720 (DF044890; F49620-76-C-0006)

AF function - advanced aerospace vehicles and turbomachinery. Opportunity - improvement in present semi-numerical methods for solving viscous flow problems. Objective - develop numerical techniques for treating both inviscid and viscous aspects of transonic flows. How work contributes - improvement in capability to perform viscous flow calculations will improve design of airfoils and turbomachinery blades.

The finite-element method of Glowinski and Pironneau will be improved to achieve better accuracy in supersonic regions and to include flows with shocks. To deal with coupled inviscid-viscous flows the technique developed by Holt and Chang for the highly yawed cone will be applied to the supercritical airfoil problem.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0007, WIND SHEAR RADAR EFFORT

R. Strauch, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab., *Boulder, Colorado* 80302 (RAA79266)

PROJECT OBJECTIVE: Develop software for testing clear air radar capability with ASR-8 radar at NAFEC. Assist NAFEC in testing and evaluating radar detection of wind shear. Devise antenna scanning strategies for measuring winds along the glide path.

CURRENT YEAR PLAN: Test and evaluate ASR-8 radar as a wind shear detection system.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin., Systems Research & Development Service

4.0008, COMMUNICATIONS - ADAPTIVE TECHNIQUES IN COMMUNICATIONS AND CONTROL THEORY

K.S. Narendra, Yale University, School of Engineering, Dept. of Engineering & Applied Science, *206 Elm, New Haven, Connecticut* 06520 (DN123505; N00014-76-C-0017)

The Navy has application for self-adaptive control systems in automatic control environments that arise in aircraft control systems, in process control, in filtering of communications channels, and in electronics operating in varying environments.

The work to be performed is concerned with theoretical questions of stability, effects of time-varying environments and the development of rapidly converging algorithms of control by adaptive techniques applicable for non-linear processes. Practical applications to adaptive array processors and adaptive control of aircraft systems will be investigated.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0009, POGO PRESSURE TRANSDUCER TESTS

P.S. Lederer, U.S. Dept. of Commerce, National Bureau of Standards, *Washington, District of Columbia* 20228 (4253405)

Project objective - determination of sensitivity and frequency response of a number of piezoelectric pressure transducers used for POGO pressure measurements in space shuttle propulsion systems.

Project approach: use of previously developed dynamic pressure calibration methods using 'windmill' and electrodynamic shaker to generate known sinusoidal pressures in liquid-filled tubes.

SUPPORTED BY U.S. Dept. of Commerce, National Bureau of Standards

4.0010, INVESTIGATION OF ELECTROMAGNETIC COUPLING THROUGH APERTURES IN CYLINDRICAL STRUCTURES

R. Mittra, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Electrical Engin, *2527 Hydrosystems Lab., Urbana, Illinois* 61801 (DN575397; N00014-75-C-0293)

Coupling of electromagnetic energy through apertures into the interior of cylindrical structures such as aircraft, missiles, ordnance or coaxial cable or waveguides is of concern to the Navy in the areas of electromagnetic compatibility, electromagnetic interference (EMI), electromagnetic pulse (EMP) protection and the safety of exposed ordnance or weapons. This research will develop methods to calculate and predict the type and amount of such coupling.

The newly developed single-aperture techniques will be extended to multiple apertures. Mutual admittance will be calculated from a creeping wave representation. The finite cylinder will be analyzed with emphasis on cylinders with radii greater than 1.5 wavelengths. By reciprocity, the receiving problem will be converted to that of a radiation of a magnetic dipole on a finite cylinder, with the radiation at a general observation point consisting of the direct creeping ray and the two edge diffracted rays from the cylinder ends.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0011, GROUND-REFERENCED VISUAL ORIENTATION WITH IMAGING DISPLAYS

S.N. Roscoe, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Aeronautics & Astronautics, *2527 Hydrosystems Lab., Urbana, Illinois* 61801 (DF049640; F49620-77-C-0117)

AF function - all computer-generated, sensor-generated, and optically generated displays that present synthetic images of the outside world have the common characteristic of producing systematic errors in size and distance judgments. Deficiency - although the correction needed for any given system and for each individual using a system can be readily established empirically by a simple psychophysical experiment, determination of the causes of the constant perceptual errors presents an elusive problem as does the identification and quantification of the independent variables that affect their magnitude. Objective - the research will correlate perceptual and oculomotor responses to variations in the visual scene, specifically in the distribution of resolvable texture surrounding centrally presented target objects, in the performance of tasks involving judgments of size and distance as encountered in flight operations. How research contributes - a complete understanding of variables contributing to biased size and distance judgments and their individual influences would allow general rules rather than specific tests to guide engineers in designing systems. Such understanding would also provide a basis for formulating testable theories of the visual perception of distance.

The technical approach involves the continuing review of current research findings, systematic refinement of a model of the oculomotor functions of the eye that will eventually account for the host of unexplained findings in the judgment of the sizes and distances of objects in the visual scene, and a program of experimentation to establish quantitative functional relationships among perceptual departures from the law of size constancy and the accommodation of the eye to distances other than that of the object to be judged, as indicated by measuring the curvature of the anterior surface of the lens and subsequently by the use of an infrared optometer. During the later phases of the program, depending on findings from the earlier phases, cortical electrical potentials will be correlated with their associated oculomotor and perceptual responses.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0012, STUDY OF AERODYNAMICALLY INDUCED VIBRATIONS

S. Fleeter, General Motors Corp., *4700 W. 10th St., Indianapolis, Indiana* 46206 (DF052350; F49620-78-C-0070)

AF function - advanced turbomachinery. Opportunity - develop predictive capability for handling aerodynamically induced vibrations that result in high cycle fatigue failures of blading. Objective -obtain data to quantify the effects of interblade phase angle, solidity and reduced frequency over a range of values relevant to forced response in turbomachinery. How work contributes - this work will provide designers with improved methods for incorporating effects of forced response of compressor blades into their design of advanced turbomachinery.

The DDA low-speed, large-scale single stage research compressor will be used to investigate the effects of the interblade phase angle, solidity variations and reduced frequency. The aerodynamically induced time-variant pressure distribution on a vane in a stator row of realistic geometry will be measured with the primary source of the excitation being the upstream rotor wakes. The variations in the parameters will be obtained by altering the number of rotor blades and stator vanes.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0013, AERODYNAMIC HEATING OF CONVENTIONAL WEAPONS

D. Maples, Louisiana State University, Agricultural & Mechanical College, School of Engineering, Dept. of Mechanical Aerospace & Ind Engineering, *University Station, Baton Rouge, Louisiana* 70803 (DF047840; AFOSR-77-3250)

AF function - aerodynamic heating of external stores is an Air Force problem with high performance aircraft. It has been specifically indentified as such in AFATL TPO-8. Deficiency - research is needed to better quantify the limitations of existing stores and to provide research alternatives to these stores where critical to performance. Objective - to conduct basic research in aerodynamic heating of conventional weapons with ultimate goals of quantifying the phenomena and providing research alternatives to existing limitations. A subsidiary objective is to design and help establish a suitable research laboratory at AFATL with completion in FY 79. How research contributes -the research will provide a basic understanding of aerodynamic heating effects on conventional weapons, through which the deficiency can be reduced or eliminated. The research contributes to RO 4.2.11 and RO 6.2.5.

The facility will be used to experimentally investigate the problem and research will be conducted to improve the state-of-the-art in thermal scale modeling.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0014, EFFECTS OF FRAGMENTS/PROJECTILES ON MISSION CRITICAL AIRCRAFT COMPONENTS

B.T. Bentley, U.S. Dept. of Defense, Army, Armament Research & Development Command, Vulnerability Lethality Div., *Aberdeen Proving Ground, Maryland* 21005 (DA0P4485)

To strengthen the methodology and data base for quantification of mission kill and mission available categories of aircraft and helicopter vulnerability.

Identify mission essential components and apply covert methodology.

SUPPORTED BY U.S. Dept. of Defense, Armament Research & Development Command, Ballistic Research Lab.

4.0015, ELECTROMAGNETIC CHARACTERISTICS OF COMPOSITE AIRCRAFT STRUCTURES AND ELECTRONICS (EMCCASE)

Unknown, U.S. Dept. of Defense, Navy, Naval Air Test Center, System Engineering Test Directorate, *Patuxent River, Maryland* 20670 (DN793176)

To study the electromagnetic characteristics of composite aircraft structures and electronics.

Not submitted.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Systems Command, Avionics Div.

4.0016, COMMUNICATIONS - SOLID-STATE ELECTRONIC COMPONENTS AND CONTROL - JSEP

N. Bloembergen, Harvard University, Cambridge Campus, Div. of Engineering & Applied Physics, *Cambridge, Massachusetts* 02138 (DN624307; N00014-75-C-0648)

To provide the Navy the technological basis for improved solid-state and electromagnetic components and devices for communications, surveillance, navigation and information handling by taking advantage of vast expertise available at institutions of recognized standing such as this one under the Joint Services Electronics Program. The study of fundamental physical and electronic processes and properties leads to advancement in the technology of lasers and optical components, heat-sensitive detectors, accurate navigation schemes, missile and aircraft guidance and control, high-performance microelectronic circuitry having small size and weight and methods for handling efficiently large amounts of data.

The subject emphasis at Harvard is in nonlinear optics, laser light scattering in liquid crystals, laser interaction with superconductors, laser interaction with semiconductors, amorphous semiconductors, control theory and applications, theory of optimized decision making, system modeling and air traffic control, nonlinear oscillations, and in electromagnetic theory antennas and radiating systems.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0017, PACKET SPEECH

B. Gold, Massachusetts Inst. of Technology, Lincoln Lab., *244 Wood St., Lexington, Massachusetts* 02173 (DF306616; F19628-78-C-0002)

The objective of this program is to develop and demonstrate techniques for efficient digital speech communication on networks suitable for both voice and data, leading eventually to better interaction between people and computers. This work is carried out in conjunction with other ARPA contractors in the network speech compression (NSC) group sponsored by the Information Processing Technology Office of ARPA.

In FY 78 efforts will be directed toward hardware implementations of low-cost CCD speech coders based on the homomorphic and channel vocoder algorithms. Development of variable rate vocoder algorithms for use in a packet network environment will be carried out. Effort will be directed toward quality improvement of existing vocoders by adaptation to the characteristics of individual talkers. Work on satellite voice conferencing will continue, with an eventual goal of an internetting conferencing capability using SATNET and the ARPANET.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Electronic Systems Div.

4.0018, UNSTEADY TURBULENT BOUNDARY LAYER BY WIND-TUNNEL EXPERIMENTS

E. Covert, Massachusetts Inst. of Technology, School of Engineering, Dept. of Aeronautics & Astronautics, 77 *Massachusetts Ave., Cambridge, Massachusetts* 02139 (DF047010; F49620-77-C-0031)

AF function - advanced aerospace vehicles. Opportunity - gain further understanding of unsteady boundary layers. Objective -investigate the unsteady boundary layer phenomena induced on a fixed, stationary, two-dimensional airfoil. How work contributes - better knowledge of the unsteady mechanisms of a turbulent boundary layer will contribute understanding of flutter, buffeting and stall flutter, all common problems for airfoils used for helicopter blades, rotating machinery blades and fixed wing aircraft lifting surfaces. The data obtained from this effort will be directly applicable to the design of future aerospace vehicles.

An experimental program will be established with the following goals: 1) Establish a boundary layer on a well-documented airfoil in a steady primary flow and provide an unsteady local outer flow. 2) Take quasi-steady pressure coefficient and boundary layer parameter measurements for comparison with the unsteady flow data to select the test geometries required to produce the unsteady local flows. 3) Select the optimum configurations and take experimental measurements of the turbulent boundary layer properties such as velocity profiles, fluctuation pressure and local skin friction.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0019, THE INVERSE PROBLEM OF SCATTERING

H.E. Moses, University of Lowell, Graduate School, *Lowell, Massachusetts* 01854 (DF046160; AFOSR-77-3169)

AF function - radar detection of aerospace vehicles. Opportunity -existing mathematical techniques promise improvements in the design and use of radar. Objective - inverse scattering techniques which should be applicable to certain microwave filter designs. How work contributes -improved techniques for inverse scattering should produce new design and analysis techniques.

Inverse scattering theory such as the Gelfand-Levitan approach has resisted application for many years due to the lack of work in areas related to range, domain, null space and their approximate analogues relevant to measurement and modeling errors. The example of design of a microwave filter as a finite length transmission line will be investigated. The range of reflection and transmission coefficient attainable and the sensitivity to modeling error will be attacked both from the small perturbation and the variational principle point of view. Additional work on three-dimensional problems, nonlinear wave equations solvable by inverse scattering transform, and ionospheric measurement will be considered, time permitting.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0020, HARP DATA REDUCTION

W. Sharp, University of Michigan, Ann Arbor Campus, School of Literature Science & the Arts, Dept. of Chemistry, *Ann Arbor, Michigan* 48104 (DF048410; AFOSR-77-3320)

AF function - aurora emissions caused by high-energy particles deposited in the ionosphere, provide a noisy IR background for satellite surveillance and detection systems. Deficiency - the characterization of the high-energy particles fluxes is insufficient to determine and predict the IR background sufficiently. These noise filters cannot be finely tuned nor auroral events distinguished from targets. Objective -this grant will allow analysis of data collected by a Univ. of Michigan instrument aboard an AF satellite. This data should better specify the energetic electron spatial distribution, the energy distribution among the electron, and the correlation with the resultant aurora. How work contributes - adds to our knowledge of electron flow and energy deposition and resultant aurora.

Data collection, partially funded by NASA, is complete. Grant would be for reduction and analysis.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0021, MOLECULAR BEAM STUDIES OF IONIZATION PROCESSES

E.W. Rothe, Wayne State University, School of Engineering, Dept. of Research in Engin Sciences, *5950 Cass Ave., Detroit, Michigan* 48202 (DF039820; AFOSR-75-2770)

AF function - surveillance, communication and other Air Force operations. Deficiency - electron affinities and bond energies of many atmospheric species are not available to help improve models of the atmosphere, and to predict electron densities in rocket plumes and reentry wakes. Objective - measure electron affinities and bond strengths for a variety of molecules including a number of importance to negative ion sources and to atmospheric phenomena. Preliminary studies with excited-state reagents using lasers and surface experiments will accomplished. How work contributes - provides fundamental data on plume and wake and atmospheric species to predict electron concentrations.

Use a crossed molecular beam device with high-energy resolution capability by a time-of-flight method and a second device with mass analysis capability to study the energetics and dynamics of collisional processes. The major interest is in determining electron affinities and bond energies of species of atmospheric interest including measurements for more complex ions such as cluster ions. Three complex ions will be created by partial condensation of the secondary beam by expansion in a nozzle source. A cesium beam will function as the electron donor to the neutral beam. Laser-excited atomic beams will be used to study excited-state ionization reactions as a function of level of excitation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0022, LASER BEAM DEGRADATION RESULTING FROM FLOW-INDUCED DENSITY FLUCTUATIONS

J.B. Miles, University of Missouri, Columbia Campus, School of Engineering, Dept. of Mechanical & Aerospace Engineering, *103 Engineering, Columbia, Missouri* 65201 (DF051550; AFOSR-78-3544)

AF function - weaponry. Opportunity - improve high-power laser design by providing quantitative understanding of laser beam degradation by propagation through a medium with turbulent density inhomogeneities. Objective - to select the optimum from among three competing theories for predicting beam degradation in turbulent flows. How work contributes - quantitatively reliable prediction of beam degradation in various circumstances related to high-power gas lasers and their use will lead to improved design of gas flow components and more effective choice of eventual combat doctrine.

Existing experimental data will be analyzed by computer, comparing results among three separate theoretical models.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0023, IMPURITY AND DEFECT BEHAVIOR IN HIGH-PURITY EPITAXIAL GAAS

C.M. Wolfe, Washington University, School of Engineering & Applied Science, Dept. of Electrical Engin, *4559 Scott Ave., St. Louis, Missouri* 63130 (DF042510; AFOSR-76-2950)

AF function - microwave solid-state electronic devices are essential components of Air Force surveillance, electronic countermeasures and communications systems. Devices made from gallium arsenide show great promise for improved performance and reliability in the microwave region. Deficiency - doping and uniformity of doping in GaAs, are generally believed to be major contributing factors in the high cost, low yield and poor reliability of present-day GaAs devices. Objective - it is the objective of this work to obtain a better understanding of the impurities and defects in GaAs epitaxial layers. How work contributes - this work will pursue the objective by looking at residual impurities, dopants and native defects in high-purity epitaxial GaAs, and in this way the research will lead to more reproducible, uniformly doped material resulting in lower-cost, improved devices.

Recent results have indicated that the problems occurring at the substrate/epitaxial interface (i.e., low-resistance region at the epitaxial/semi-insulating substrate interface or high-resistance region at the epitaxial/heavily-doped substrate interface) are caused by the manner in which the residual or intentionally added dopants are incorporated into the epitaxial layer near the substrate. In order to clarify these early indications, growth and doping experiments will be carried out with different substrates and dopants and with detailed impurity profile measurements in order to verify the preliminary theories and to investigate possible means of avoiding these interfacial regions. Work will continue on the annealing experiments on undoped and doped samples in order to obtain a better understanding of the self-compensation effect in GaAs. Research will also continue in the general area of understanding intentionally added impurities and stoichiometric defects in GaAs, including a determination of the interaction between various impurities and defects and a study of the manner in which impurities and defects are incorporated into the growing epitaxial layer. This research will include the growth of a large number of epitaxial layers under varying conditions (different dopants, substrates and growth rates) by vapor phase epitaxy. Differential capacitance, resistivity, Hall and photoluminescence measurements will be made to determine the total impurity, defect or complex donor concentrations, the impurity profile and the identification of different species.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0024, DEVELOPMENT OF REAL-TIME VIDEO TRACKING CONCEPTS 13857-EL

G.M. Flachs, New Mexico State University, Las Cruces Campus, School of Engineering, Dept. of Electrical Engin, *University Park, Las Cruces, New Mexico* 88003 (DA0E9145; DAAG29 76 G0231)

To develop concepts and techniques for performing picture decomposition, initial target acquisition, multiple target tracking, and structural recognition required to automatically track targets with a TV camera control system. Relevance - successful completion of this research effort will result in configuration of a system that will substantially improve the cost-effectiveness of optical data collection and processing, and greatly increase the effectiveness of all DOD missile and aircraft flight-testing programs.

Initial efforts in these areas have established effective methods that have demonstrated real potential in tracking a limited class of targets. The research proposed extends the present techniques to a larger class of targets, and establishes firm scientific foundations for the development of reliable and fast target tracking algorithms capable of handling the real-time tracking environment.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0025, DEPENDENCE OF HYDROMAGNETIC ENERGY SPECTRA ON INTERPLANETARY PARAMETERS

A. Wolfe, City University of New York, Brooklyn College, Graduate School, *Bedford Ave. & Ave. H, Brooklyn, New York* 11210 (DF053380; AFOSR-78-3707)

AF function - magnetospheric disturbances canaffect both ground-based and space-based communication, detection and surveillance systems. Deficiency - the relationship between solar wind parameters and the excitation of hydromagnetic waves in the magnetosphere has not been determined. Objective - to study associations and correlations between ground-based magnetic pulsations and variations in the interplanetary magnetic field and plasma. Contribution - this work will elucidate dayside hydromagnetic wave generation mechanisms and the propagation of hydromagnetic waves from the magnetopause to the earth.

Hourly power spectral analyses will be computed for the magnetic horizontal component data from Pittsburg, N.H. (l equals 3.5). The period bands 30-60 sec., 60-120 sec. and 120-240 sec. will be investigated for local daytime hours for a fifteen-day interval in 1975 when good interplanetary data coverage from the IMP J spacecraft exists. Multiple linear regression methods will be used to select the most important interplanetary

parameters affecting observed ground activity. Power spectral analyses of the high time resolution interplanetary magnetic field data will be performed to study magnetic energy transfer to the ground.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0026, GROUND AND TROPOSPHERE LOW-FREQUENCY EFFECTS

J.L. Heckscher, U.S. Dept. of Defense, Air Force, Rome Air Development Center, *Griffiss Air Force Base, Rome, New York* 13441 (DF904160)

Development of an in-house theoretical and experimental capability to predict and measure low-frequency radio propagation over irregular, inhomogeneous terrain. Development of techniques to determine earth characteristics which influence the ground wave. Improvement of methods of incorporating physiographic data into the equations of ground wave propagation. Study effects of troposphere inhomogeneities on ground wave stability. Improve and extend VLF/ELF systems by identifying and measuring electrical noise caused by motion of aerosphace vehicles through the troposphere. Refine new techniques for advanced detection of dangerous charge build-up in clouds, to improve lightning warning and to provide the basis for lightning damage avoidance systems.

The in-house theoretical capability will be accomplished beginning with existing 'residue series' ground wave propagation equations for the smooth round earth formulated by van Pol and Bremmer and used by Wait and Johler and continuing with the integral equation approach development by Hufford and others. The equations will be cast into forms suitable for high-speed digital computation and numerical predictions for specific paths will be compared. The experimental capability will be realized with construction of equipment to transmit LF pulses having only one or two radio frequency cycles. In conjunction with existing digital receiving techniques, this short pulse device will constitute a precision tool for the measurement of LF propagation. Soil characteristics represent one of the least well-known of the various factors required for accurate ground wave prediction. Inversion of the integral equation results in a solution for the surface impedance in terms of the attentuation function and the path topology. A hybrid method, to account for terrain irregularities by a perturbation of the smooth round earth solution, may result in a significant reduction in computation time. Stability will be studied by observing time-of-arrival of LORAN pulses, using ultra-stable cesium standards as the local reference. Improved VLF/ELF reception on aircraft will be sought by studying techniques which can either reduce the sensitivity of the receiving system to the noise, or which can act directly to diminish the intensity of the noise itself. A new prototype electrograph will be built and installed at CCAFS. (Text Abridged)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0027, GROWTH AND PROPERTIES OF INP

J.K. Kennedy, U.S. Dept. of Defense, Air Force, Rome Air Development Center, *Griffiss Air Force Base, Rome, New York* 13441 (DF902880)

AF function - integrated optics and signal processing. Deficiency - materials deficiencies in integrated optics and signal processing devices. Objective - to determine the preparation and growth parameters necessary to produce high quality bulk single crystals of InP and other III-V's for use as substrates for device fabrication. How research contributes - indium phosphide has great potential for the Air Force as a substrate material both for integrated optical communication systems and signal processing systems. The potential of test devices have already been demonstrated, however the high cost, poor quality and lack of reproducibility and reliability of the indium phosphide substrates is a major roadblock to the successful exploitation of this material.

Most of the commercially available indium phosphide single crystals are grown in Great Britain although one domestic vendor started supplying in limited quantities earlier this year. The cost of this material is very high and the quality varies appreciably from batch to batch. To supply our in-house device fabrication needs we intend: (1) To investigate and develop a synthesis procedure for the preparation of high-quality polycrystalline indium phosphide. (2) To use the polyscrystalline indium phosphide prepared in (1) to grow high-quality undoped, N-type P-type, and semi-insulating indium phosphide single crystals using the liquid encapsulation technique.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0028, TIME-DEPENDENT HYPERSONIC VISCOUS INTERACTIONS

E. Reshotko, Case Western Reserve University, School of Engineering, Dept. of Fluid Thermal & Aerospace Sci, *University Cir., Cleveland, Ohio* 44106 (DF037500; AFOSR-74-2577)

AF function - aerospace vehicles. Deficiency - lack of knowledge of effects of free stream turbulence on boundary layer behavior. Objective - to develop analytical procedures for predicting boundary layer transition due to free stream turbulence. Evaluation of the influence of test facilities on boundary layer transition in the range of Mach 7 to Mach 10 will be accomplished. How work contributes - this research is part of a comprehensive program in turbulence and turbulent flow to provide a better understanding of the phenomena so that the effects can be considered in the design of advanced aerospace vehicles.

An analytical study modeling the effect of vortices and irrotational traveling wave distrubances in the free stream on boundary layer transition. Where convenient, the analytical study is supplemented with numerical experiments.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0029, FEASIBILITY STUDY OF DIRECT-DRIVE ELECTRICAL/HYDRAULIC/FLUIDIC SERVO VALVE

J. Demarchi, Rockwell International Corp., *4300 E. 5th Ave., Columbus, Ohio* 43216 (DN881494; N62269-78-C-0176)

The basic objective of this effort is to investigate the feasibility of improving the survivability characteristics of an electric flight control actuator servo valve with a fluidic backup provision. This contract supports work unit ZA601, Agency Accession No 681080.

This program shall consist of a data survey of industry and goverment sources to obtain quantitative data on fluidic applications for backup systems to the primary driving system. A set of baseline component and system requirements will be established and existing hardware will be investigated to determine the kind and extent of modifications necessary for adaptation. A configuration concept including preliminary drawings and a conceptual test system arrangement will be established. Pertinent data and drawings will be included in a final report.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

4.0030, FIBER-OPTIC SYSTEM EVALUATION LABORATORY

E.N. Humphreys, U.S. Dept. of Defense, Air Force, Avionics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF094640)

To supply the Air Force with information and data on fiber-optic data transfer components and subsystems and to provide an in-house capability to analyze, test, and verify the feasibility of selected aspects of optoelectronic technology.

A selected range of internal data transfer requirements for aerospace vehicles will be addressed under this effort. This includes: (1) multiplexed fiber-optic data buses, (2) multiplexed fiber-optic point-to-point systems and (3) dedicated point-to-point (both analog and digital) fiber-optic systems. This effort will (a) design, fabricate and test electrooptical data transfer links, (b) develop and test various approaches to fiber-optic terminations, handling and repair, (c) investigate input/output devices for the electrooptical data links in order to achieve system optimization, (d) develop dynamic analyzer test programs for testing optical and electrooptical components and systems in a simulated operational environment and (e) evaluate components, model

and validate systems, and test and evaluate prototypes to provide a data base for system component selections for future aerospace vehicles. An in-house lab will be established to measure and test components and subsystems. New data will be gathered and data from other sources will be verified. By gaining expertise in the area, recommendations can be made to branch and division on use of fiber-optics technology in other system development programs. The lab will be capable of measuring light sources, photo detectors and optical fibers, both as components and in systems. Data signals will be analyzed before transmission over a fiber-optic link and then afterwards to evaluate bit error rate for various configurations. Other tests will be performed to establish lifetime of components, survivability of components and systems subjected to vibration and temperature extremes and the reliability of systems that have been assembled from component parts.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Avionics Lab.

4.0031, DEVELOPMENT OF MECHANICAL SYSTEMS FOR EXTENDING TECHNOLOGY OF AERODYNAMIC GROUND TESTING

J.M. Hample, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF141570)

The severity and complexity of the effect of the aerodynamic and thermodynamic environments on military vehicles increases as more stringent performance requirements are demanded. Consequently, new materials and configurations must be developed to negate the effect of the new requirements. Aerodynamic test facilities must be continually improved to provide the changing environment in which the performance of these new materials and configurations can be verified in a cost-effective, timely manner. The objectives of this program are to develop and implement new technologies associated with fluid processing systems, mechanical and structural containment, model support and articulation systems, and improving effectiveness, reliability and maintainability of aerodynamic ground test facilities.

Use in-house capability supplemented by engineering consultation and contacts on specific programs requiring unusual talents, expertise and hardware not available in-house. New techniques and hardware will be evaluated and applied to new and existing systems and facilities. Performance will be measured in terms of cost-effectiveness, manpower requirements and the effect on the environment as well as applicability to current and anticipated problems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

4.0032, PROPULSION TECHNOLOGY

E.E. Bailey, U.S. Dept. of Defense, Army, Aviation Research & Development Command, Air Mobility Research & Development Lab., *21000 Brookpark Rd., Cleveland, Ohio* 44135 (DA0E3534)

Implement research and development program for advanced propulsion and drive train components relevant to current and potential future Army aircraft application. Provide the technology base for evaluation of concepts for improvement and application including considerations for related needs in fabricational techniques.

In joint participation with NASA-Lewis Research Center, conduct analyses, element design, fabrication, tests, and breadboard hardware evaluation of advanced propulsion and drive train concepts. Work is jointly conducted with NASA in their facilities with emphasis on turboshaft engine technology including compressor, turbine, combustor and the resulting requirements on seals, shafting, bearings, gears, and material.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Air Mobility Research & Development Lab.

4.0033, VISCOUS FLOWS IN HIGH-SPEED FLIGHT

R.T. Davis, University of Cincinnati, School of Engineering, Dept. of Aerospace Engineering, *101 Baldwin Hall, Cincinnati, Ohio* 45221 (DN023017; N00014-76-C-0364)

The development of accurate methods to predict the viscous flow (attached or separated) over broad classes of body shapes is essential for the efficient design of high-speed airplane and missile configurations. This theoretical research will concentrate on the nature of separation and reattachment; the flow about bodies in non-uniform flows; and numerical solutions of the Navier-Stokes equations to assess and to formulate analytical models.

Classically in fluid mechanics the flow about a body is divided into an inviscid external flow covering most of the field and a thin viscous boundary layer. As the Reynolds number decreases and/or the Mach number increases, or if separation plays a significant role, this classical division ceases to be valid; higher-order effects become increasingly important. This research will tackle a broad class of such problems with particular emphasis on the separation and reattachment phenomenon.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0034, ADSORPTION AND ADHESION ON LASER WINDOWS

W.E. Moddeman, University of Dayton, Research Inst., *300 College Park Ave., Dayton, Ohio* 45469 (DF053090; AFOSR-78-3666)

AF function - laser optical systems will play an important role in future AF weapon and communications developments. Deficiency - present lasers are degraded in performance by the adsorption of water onto surfaces and interfaces of antireflective (AR) coated window materials. Objective - the objective of this study is to a) determine which atmospheric components bind, and to what degree they bind to the surface of laser window materials, and b) understand the role that surface adsorbed impurities play in the adhesion of AR coatings to the laser window. How work contributes - understanding and controlling the surface chemistry during manufacture will lead to better AR coatings that are mechanically strong and exhibit high optical transmission.

This research will utilize new surface analytical techniques (AES, ESCA, SIMS) to examine the adsorbed species on several alkali and alkaline earth-fluorides. Original, cleaned, and coated surfaces will be analyzed in order to correlate adsorption characteristics with coating adhesion and window performance.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0035, ELECTRON IMPACT EXCITATION OF LASER MEDIA

D.E. Golden, University of Oklahoma, Norman Campus, Graduate School, *660 Parrington Oval, Room 101, Norman, Oklahoma* 73069 (DF041610; AFOSR-75-2866)

AF function - this research contributes to RO 6.3, electromagnetic weaponry. Deficiency - basic parameters necessary for the design of electric discharge lasers are needed. Objective - to measure parameters needed in the design of lasers pumped by electron impact. Contribution - measurements are being made on parameters used in designing electric lasers.

Measurements are being made of electron impact excitation cross sections, optical branching ratios of the subsequent decays, excited-state lifetimes, polarization of the radiation, and collisional deactivation decay rates in the case of metastable excitation for a number of target atoms and molecules. The measurements are being performed at sufficient electron energy resolution so that particular attention can be directed toward the role of resonances in the excitation process. The experimental design is such that high-energy resolution measurements can be performed with sensitivities much larger than previously thought possible.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0036, IONIZATION AND AEROSOL PARTICULATES IN THE MIDDLE ATMOSPHERE 15733-GS

L.C. Hale, Pennsylvania State University, University Park Campus, School of Engineering, Dept. of Electrical Engin, *101 Hammond Bldg., University Park, Pennsylvania* 16802 (DA0F9252; DAAG29-78-G-0129)

To investigate the processes which determine the electrical structure of the middle atmosphere with emphasis on the electron attachment and detachment processes which control free electron density in the ionospheric d-region. Relevance - the investigation will provide data with which (1) to validate the ASL d-region model used to predict d-region absorption under disturbed atmospheric conditions, (2) to determine absorption effects upon Army communications and BMD systems, and (3) to explain unexpected ballistic target signal enhancement and other phenomena in the d-region.

Use two different types of rocket-launched payloads with newly designed instruments to measure relevant charged particle properties during undisturbed day and night conditions, and during the 26 February 1979 solar eclipse totality conditions. Numerical rates will be generated for use in models of the electronic parameters, and information will be sought for the properties of small aerosol particulates in the middle atmosphere.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0037, APPROXIMATION METHODS IN MULTIDIMENSIONAL FILTER DESIGN

N.K. Bose, University of Pittsburgh, School of Engineering, Dept. of Electrical Engineering, *402 Engineering Hall, Pittsburgh, Pennsylvania* 15213 (DF051090; AFOSR-78-3542)

AF function - to design optimal cost-effective digital filters for radar, image processing, and telemetry systems. Deficiency - the advantages of digital signal processing are so compelling that the Air Force (as well as commercial communications companies) is gradually converting all communications to digital systems. The applications requiring two or more dimensions, such as video information, still contain some technological problem areas that prevent the economic usage of similar digital techniques. Objective - to advance the theory of approximation of functions of several variables by rational functions, in order to effectively design realizable filters that closely approximate the performance of a desired ideal performance. How work contributes - success in this research could lead to vastly improved digital circuitry for the various electronic systems used in aerospace vehicles and communications networks.

Approximation theory in one real variable makes use of the Haar condition, which does not hold in the more general situation. The plan is to study various schemes that can be devised to partly overcome this obstacle. The results of the approximation investigations will be applied to actual multidimensional filter design problems where the desired frequency response function is given.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0038, RESEARCH IN GAS LASERS

T.F. Morse, Brown University, Graduate School, Dept. of Engineering, *University Hall, Box 1883, Providence, Rhode Island* 02912 (DF038310; AFOSR-74-2645)

AF function - weaponry. Opportunity - kinetic theory and fluid mechanical knowledge are continuing to improve the basic understanding of gas lasers. This principal investigator distinguished himself during the former AFOSR rarefied gas dynamics program, and under the present grant he has made significant contributions to the technical literature of gas laser kinetics. Several aspects of the fluid mechanics and kinetics of gas lasers still require clarification to facilitate improved design capabilities. Objective - to apply previously developed velocity dependent rate equations for nonlinear radiative effects to optical pumping by gas lasers. How work contributes - this work will apply a previous treatment of the interaction of two radiation fields with three-level atoms to some important problems occurring in molecular gas flow lasers.

Theoretical work will deal with the kinetics of optical pumping, considering nonlinear radiative effects and arbitrary spectral broadening, along with rotational and vibrational relaxation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0039, TRANSIENT AIRFLOW MEASUREMENT

S. Webofer, Arnold Research Org. Inc., *Arnold Air Force Base, Tullahoma, Tennessee* 37389 (DF420953; F40600-77-C-0003)

The objective of this effort is to develop a method to measure engine transient airflow and to calibrate an Air Force Aero-Propulsion Laboratory (AFAPL) engine inlet bellmouth system for use in transient airflow testing of a J85 engine.

An experimental test facility will be fabricated using a critical flow venturi in series with a throttling plug assembly (TPA). The TPA will consist of a shrouded bullet-nose and strut assembly and a translating variable area plug. The TPA will be calibrated for airflow rates as a function of plug position.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Arnold Engineering Development Center

4.0040, INVESTIGATION OF EVOKED POTENTIALS RELATED TO SIMULATOR ONSET CUES

W.H. Jermann, State University & Community College System of Tennessee, Memphis State University, School of Engineering, Dept. of Electrical Engin, *Southern Ave., Memphis, Tennessee* 38111 (DF052610; AFOSR-78-3626)

AF function - supports the AF flight simulator procurement program. Deficiency - the degree of fidelity necessary in flight simulators is currently being debated. Incomplete data about the types of motion and visual cues necessary for effective simulation makes design considerations complex and subject to error. Better information is needed regarding fidelity requirements. Objective - the objective of this research is to determine if evoked potential technology can be useful in discriminating higher priority vs redundant cues in simulation. How research contributes - if the evoked potential methodology is validated, it offers an objective performance measurement technique which will provide design data which can impact procurement decisions.

Evoked potential measures will be taken for subjects sensing visual motion, sensing the motion of a deflatable seat, and the interaction of tilt and visual input. Response measures will be correlated with the physical stimuli to ascertain if the evoked potentials reflect the sensations of motion.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0041, EXPERIMENTAL MEASUREMENTS IN UNSTEADY TURBULENT BOUNDARY LAYERS WITH PRESSURE GRADIENTS 13367-EX

R.L. Simpson, Southern Methodist University, School of Engineering & Applied Sciences, Dept. of Electrical Engineering, *Hillcrest & University, Dallas, Texas* 75222 (DA0E9056; DAAG29 76 G0187)

To obtain fundamental experimental data of accelerating and decelerating unsteady turbulent boundary layers in order to improve understanding of turbulent flow structure near unsteady separation. The research will fulfill, in part, the requirement for experimental verification of theoretical analysis for unsteady turbulent boundary layers, the characteristics of which control the dynamic stall of helicopter rotors.

An experimental investigation utilizing a wind tunnel with downstream rotating damper blades to produce an unsteady turbulent boundary layer will be conducted. Detailed turbulence structure measurements using hot-film and laser anemometry will be made all along the length of the test section.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0042, EMPLOYMENT IMPACTS OF THE DEPARTMENT OF TRANSPORTATION'S MAJOR GRANT PROGRAMS

Unknown, Jay W. Kim International Corp., *7617 Little River Tpke., Suite 800, Annandale, Virginia* 22003 (OS-80113; OS161469 (TRAIS NO.))

This study is to develop a systematic evaluation that would allow public policy makers to compare potential employment generated by various levels and types of transportation expendi-

tures and assess the relative merits of specific funding recommendations. The principal objective is to provide comparable estimates of the employment impacts of the DOT's major grant programs, including airport, railroad, highway and public transportation construction and operating assistance programs. This will require a review of existing information, and studies and the assessment of the reliability of the data and technique used.

SUPPORTED BY U.S. Dept. of Transportation, Office of the Secretary of Transportation

4.0043, ORBITAL PHOTOGRAMMETRIC TRIANGULATION WITH TRANSLATIONAL AND ROTATIONAL DYNAMICAL CONSTRAINTS 15551-GS

J.L. Junkins, Virginia Polytechnic Inst. & State University, Graduate School, *Blacksburg, Virginia* 24061 (DA0F9148; DAAG29-78-G-0043)

To develop improved methods for orbital photogrammetric triangulation which has a potential for resulting in improved prediction aspects of the orientation of the spacecraft. Relevance - accurate mapping and point positioning have obvious relevance to a variety of military activities. The planned work shows promise of contributing to a better capability for controlling photogrammetric procedure from spacecraft. Engineer topographic laboratories and Defense Mapping Agency scientists have attested to the relevance of the proposal.

Methods will be developed to reduce the number of unknown parameters and thus simplify the consideration of the translationally and rotationally constrained variables of a camera in space. The central new idea is that the rotational motion of the camera (spacecraft fixed) must be a rigorous solution of the spacecraft's rotational equations of motion. This is a continuation of work initiated under Accession Number DA0E9282.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0044, THE DEVELOPMENT OF A SEPARATION MODEL FOR TWO-DIMENSIONAL AIRFOILS IN TRANSONIC FLOW 15866-E

F.A. Dvorak, Analytical Methods Inc., *110 116th Ave. S.E., Bellevue, Washington* 98004 (DA0G8937; DAAG29-79-C-0004)

To develop an analysis method for transonic separated flows over two-dimensional airfoils. Relevance - the research is relevant to current Army requirements for airfoil and rotor blade design tools. The program has a specific application to the problem of predicting helicopter blade pitching moments and thereby impacts on the designer's ability to predict control system loads.

Existing numerical methods for describing two-dimensional transonic potential flows based on the full potential equation will be coupled to and iterated with a vortex sheet representation for the boundary layer and separated wake regions.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0045, RESEARCH ON TEST RANGE INSTRUMENTATION FOR MISSILES AND ROCKETS 14855-A-E

K.M. Pell, University of Wyoming, School of Engineering, Dept. of Mechanical Engineering, *P.O. Box 3435, University Station, Laramie, Wyoming* 82070 (DA0F8944; DAAG29 77 G0090)

To develop analytical models for processing data obtained from a remote laser attitude sensing system for missiles, to investigate remote attitude determination techniques applicable to non-rolling or slowly rolling missiles and to investigate pressure measurement techniques adaptable to range instrumentation. Relevance - data required in research and development testing of tactical weapon systems includes the rapid determination of vehicle position and attitude as a function of time. This research directly addresses this requirement and is strongly relevant to the missile test range instrumentation requirements at the Army Missile Command.

Alternative mathematical formulations for the attitude sensing system reflecting missile dynamic conditions, sensitivity and relative position, and efficient solution algorithms will be performed. Different on-board reflector configurations will be investigated for use on slowly rolling vehicles and system concepts applicable to on-board pressure measurements will be defined.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0046, THE NON-LINEAR AERODYNAMIC CHARACTERISTICS OF FINNED SLENDER BODIES AT HIGH ANGLES OF ATTACK

J. Rom, Technion, Research & Development Foundation Ltd., *P.O. Box 4910, Haifa, Israel* (DA0D9374; DAERO 78 G0002)

The objective of the research program is to study the non-linear aerodynamic characteristics of slender bodies at high angles of attack both in the normal and in the lateral directions. The development of a method for evaluating these aerodynamic characteristics, and an experimental program which will result in a better understanding of methods for influencing the position and strength of the shed vortices at high angles of attack will be accomplished.

The experimental program will include the following areas- (1) visualization tests in a subsonic wind tunnel for flows over slender sharp and blunt ogive nosed clyindrical bodies with and without canard fin configurations. Tests will be conducted at angles of attack up to 90 degrees. (2) introduction of blowing ports or small streaks to effect the position and strength of the vortics and their interaction on the body. (3) measurements of the six components of the static aerodynamic forces and moments on selected configurations at transonic and supersonic speeds at angles of attack of up to 50 degrees and 80 degrees. The calculation method will include: (I) review of the methods for prediction of boundary layer separation position on slender configurations. (II) Develop a computer program which will include the computation of the vortices strengths and positions and by an interactive procedure evaluate the flow configuration and the non-linear aerodynamic characteristics.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Research & Standardization Group

4.0047, APPLICATION OF FUNCTIONAL ANALYSIS IN FLUID MECHANICS

L. Napolitano, Universita degli Studi di Napoli, *1 Corso Umberto, Naples, Italy* (DF051250; AFOSR-78-3484)

AF function - aerospace vehicles. Opportunity - future Air Force aerospace vehicles will be required to fly at high speeds and have an ability to maneuver at these speeds with increased efficiency. This will require that new and improved engineering design and analysis methods be developed throughout the total regime for the precise engineering determination of the performance and system capabilities of those vehicles. Objective - this research will attempt to develop new methods for fluid dynamical analysis using high-speed computers, methods which should circumvent the disadvantages of currently employed machine algorithms. How work contributes - the great success of the finite-element method in solid mechanical problems will require the application of functional analysis to unify the many treatments in the literature.

This research will systematically apply functional analysis to the development of finite element techniques for the solution of fluid mechanical problems, thereby unifying the many treatments in the literature that now appear superficially different and framing into a clearly defined context the problems and questions that still remain to be resolved before finite-element methods can be employed rigorously and economically in fluid mechanical analysis.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0048, MEASUREMENT OF PERHYDROXYL REACTION RATES

Unknown, University of Cambridge, Christs College, *Cambridge, England, United Kingdom* (FA77WA-4054; FA160419 (TRAIS NO.))

Using laser magnetic resonance techniques, in a discharge flow system at total pressures near 1 Torr and generating HO2 by the reaction of free atoms with hydrogen peroxide, measure the temperature dependence of the reaction. Using laser magnetic resonance techniques, in a discharge flow system at total pressures near 1 Torr and generating HO2 by the reaction of free atoms with hydrogen peroxide, measure the rate coefficients.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

4.0049, SCANNING TRANSMISSION ELECTRON MICROSCOPY OF ELECTROMAGNETIC STRUCTURES

R.S. Tebble, University of Salford, *The Crescent, Salford, England, United Kingdom* (DF041860; AFOSR-76-2896)

AF function - advances in command, control and communications depend directly upon the reliability and performance of electromagnetic devices which are in large measure dependent upon the solid-state electromagnetic materials of special and unique properties and behavior. Opportunity - newly developed instrumentation in England provide a timely opportunity to investigate the electronic and magnetic structures and phases as well as the crystallographic features, defects and interfaces of a variety of materials used and needed in solid-state electromagnetic devices. Objective - the determination of segregation effects at interfaces in junction devices, defects and impurities in semiconductor compounds such as Si, GaAs, Gap, InP, PbTe and ZnSe is the aim of this research. Doped silicon is of special interest not only as an established solid-state device material but is of particular interest in its amorphous form. The effects of ion-implantation with suitable elements such as phosphorus are being studied. Amorphous silicon and alloys such as GdCo and Fe-Ni-(P,C,Si) are also being investigated. How work contributes - these investigations should result in a more precise resolution of impurities defects and stacking faults in the solid-state materials used in electromagnetic devices and should therefore lead to a better and improved materials technology for electromagnetic devices.

Novel techniques of selected area scanning transmission electron microscopy, high-voltage, high-resolution conventional transmission electron microscopy and selected area electron and x-ray diffraction analyses are being applied to the determination of crystallographic, topographic and morphologic features of electromagnetic materials of technological interest.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, ENVIRONMENTAL DISTURBANCE EFFECTS ON IONOSPHERIC SYSTEMS (PART OF BLOCK PROGRAM FOR EM/EO PROPAGATION)

I.J. Rothmuller, U.S. Dept. of Defense, Navy, Naval Ocean Systems Center, Environmental Sciences Dept., *San Diego, California* 92152 (DN034000)

Develop near-earth environmental disturbance forecasting models which use sensors such as the Navy SOLRAD satellite to predict degradation effects on military communication, navigation, surveillance and other command control systems. Develop these models in support of the SOLRAD development test and evaluation task. Produce theoretical and applied models along with the software necessary for real-time assessment and prediction of the impact on naval C3 systems of variations in the near-earth environment.

Use theoretical considerations of the processes that affect electromagnetic propagation to develop applied empirical and semi-empirical models which can be used to assess and forecast the effect of environmental factors on various naval electromagnetic systems.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Environmental Prediction Research Facility

5.0002, IONOSPHERIC PHYSICS

K. Davies, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab., *Boulder, Colorado* 80302 (8DJ4 07 20)

OBJECTIVE: To advance knowledge and understanding of the ionosphere via research and experimentation to more effectively use the upper atmosphere resources in activities of national importance. Development goals for service include prediction of ionospheric/magnetic storms minimizing natural disturbances to radio communications, electric power distribution system, telephone system, etc.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab.

5.0003, SOLAR CONVECTION AND OBSERVED ATMOSPHERIC MOTION

J. Toomre, University of Colorado, Boulder Campus, School of Arts & Sciences, Dept. of Astrophysics, *1200 University Ave., Boulder, Colorado* 80302 (DF248990; F19628-77-C-0104)

AF function - communications, surveillance, detection, tracking. Deficiency - inadequate solar disturbance predictions. Objective -determine the mechanism responsible for the generation of solar surface magnetic fields and develop an understanding of the long-term behavior of these fields. How research contributes - a complete model of solar magnetic field generation including dynamo processes will enable long-term preductions of solar activity to be made.

Determine observationally the parameters of observed solar surface motions. From these the properties of the underlying connection and the detailed process of dynamo generation of solar magnetic fields can be deduced. By extending these studies into the chromosphere by using space observations in the UV the mechanisms of magnetic field concentration and subsequent release in flares can be investigated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0004, GEOMORPHOLOGY, FLORA AND VEGETATION OF PHOENIX ISLANDS

F.R. Fosberg, Smithsonian Institution, Dept. of Botany, *1000 Jefferson Dr. S.W., Washington, District of Columbia* 20560

Reconnaissance study of geomorphology, correlated with vegetation, of six of the eight Phoenix coral islands; detailed semi-descriptive flora based on authors' collections and all available previous collections, and on records and data from literature. Vegetation patterns and land-form data supplemented by study of air photos.

SUPPORTED BY Smithsonian Institution, National Museum of Natural History

5.0005, COMPREHENSIVE ANALYSIS OF CARBONACEOUS CHONDRITES

K. Fredriksson, Smithsonian Institution, Div of Meteorites, *1000 Jefferson Dr. S.W., Washington, District of Columbia* 20560 (3350-04)

Orgueil and possibly other carbonaceous meteorites will be separated chemically and mechanically. Mineralogical, chemical and organic composition of each fraction will be determined by various techniques in different laboratories. An exceptionally clean 25 gram sample of Orgueil has been obtained for this project.

SUPPORTED BY Smithsonian Institution, National Museum of Natural History

5.0006. STRATOSPHERIC DATA EVALUATION

Unknown, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Weather Service, National Meteorological Center, *5200 Auth Rd. S.E., Washington, District of Columbia* 20023

OBJECTIVE: To determine the compatibility between various types of stratospheric data so that such information may be used most effectively in various analysis systems.

STATUS: Studies of the compatibility of different types of radiosonde-, rocketsonde-, and satellite-data are being continued in order to derive necessary corrections. Preliminary results regarding the value of AIDS data from supersonic Concorde flights have been derived.

PLANS FOR FY79: Results of the various data evaluations will be used to update the data adjustment scheme used in the preparation of high-level synoptic analyses (100-0.4 mb).

SUPPORTED BY U.S. Dept. of Commerce, National Weather Service, National Meteorological Center

5.0007. ENVIRONMENTAL REMOTE SENSING

V. Noble, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN220038)

Operational commanders can improve mission effectiveness by exploitation of environmental intelligence only when the environmental parameters are quantified and provided in a timely, deterministic manner in a useable format. The objective of this effort is to develop sensors, analysis methods, and display techniques for improved command support.

Theoretical studies and field measurements are carried out to establish analysis techniques for determination of oceanographic parameters from interaction of electromagnetic waves with the sea surface. Sensors will be developed, and their performance evaluated to confirm that their measured outputs do quantify the sea surface parameter to the accuracy and precision necessary for Navy needs.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

5.0008. STRUCTURE OF THE PLANETARY BOUNDARY LAYER OVER A COMPLEX MESO-REGION

B. Ackerman, University of Illinois, Urbana Champaign Campus, State Water Survey Div., *Water Resources Bldg., Urbana, Illinois* 61802 (ATM7807800)

This is a study of the structure of the planetary boundary layer (PBL) over a 2,000 square mile complex meso-region. The region to be studied has modest topographic relief, is largely agricultural, and contains a major metropolitan area. The research seeks to add to the understanding of the boundary layer processes through quantitative description of the dominant thermal and kinematic properties of the PBL over surfaces of different physiothermal characteristics, and through identification and evaluation of some of the physical processes by which that structure is modified.

The research is based on an existing data set collected during field experiments in both winter and summer in the area around St. Louis, Missouri. The data include aircraft measurements of the mean and turbulent components of wind, temperature, and moisture, plus vertical profiles of these parameters obtained with balloons and helicopters.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0009. CLIMATOLOGICAL AND STATISTICAL ANALYSIS

J. Mettauer, Regis College, Undergraduate School, *235 Wellesley St., Weston, Massachusetts* 02193 (DF580580; F19628-78-C-0153)

AF function - design of aerospace systems. Deficiency - requires meteorological and climatological data in greater detail and complexity for adequate design and aerospace operational doctrine. Objective - to perform mathematical and statistical studies on meteorological and climatological data. This includes developing statistical presentations that can be used for estimating the integrated effects of temperature, density and wind on aerospace vehicles, develop and test statistical models that support the utilization of weather-sensitive AF systems, and develop mathematical models that estimate the simultaneous occurrence of weather events at one or more geographical locations. How development contributes - describes the variability of atmospheric parameters in formats required in AF design and operation.

The principal investigator has extensive experience in statistical and probabilistic modeling of atmospheric phenomena. He will apply his expertise in mathematical and statistical theory along with computer techniques to the climatic record in order to develop and test the models mentioned in the objective.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0010. STRATOSPHERE-MESOSPHERE TIME-SPACE RELATIONSHIPS

A.E. Cole, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF581530)

AF function - design and operation of aerospace vehicles. Deficiency - distribution as well as time and space variations of wind and the thermodynamic properties of the atmosphere for levels up to 100 km must be known in order to establish design criteria and operational procedures for various types of reentry vehicles. Objective - to develop mathematical models of the atmosphere which portray the time and space variations of temperature, density and wind at altitudes up to 60 km and complete a set of mean monthly atmospheres to 90 km for 15 degrees intervals of latitude. How development contributes - a more detailed knowledge of atmospheric structure below 100 km will be important in targeting and in the design of systems for intercepting ballistic missiles.

Mathematical models of the atmosphere will be developed using all available rocket observations of temperature and density at heights between 30 and 100 km and appropriate radiosonde data for levels below 30 km. Statistical techniques will be used to develop models of the time and space variations of temperature, density and wind for levels up to 60 km. Statistical arrays that describe the decay in the coefficients of interlevel correlations with increasing altitude separation will be derived from analyses of radiosonde and rocketsonde data. The decay of the coefficient of correlation of temperatures and densities between two points with increased horizontal separation will be developed from nearly simultaneous observations for various locations and from data taken from published 10,5, 2 and 0.4 mb maps, prepared on a weekly basis by NOAA. The decay in the correlation coefficients with time (1-24 hours) will be developed from published observations. Part of the work under this work unit was formerly carried out under work unit 86240106.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0011. ENHANCEMENT OF REMOTE SOUNDINGS

V.J. Falcone, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF580310)

AF function - weather forecasting, weapons delivery, surveillance. Deficiency - inability to determine meteorological conditions over inaccessible or unfriendly territory. Objective - demonstrate enhancement of satellite sensed temperature profiles arising from microwave sounder in cloudy atmosphere. How research contributes -improve the ability to analyze and forecast atmospheric parameters of importance to military operations and contributes to sensor development for DMSP.

Techniques of calculating radiative transfer cloudy atmospheres will be investigated (the forward problem). These calculations will then form a data base to infer temperature profiles for realistic atmospheric and earth background conditions. The initial attempt to infer temperature profiles will utilize 'state-of-the-art' inversion techniques which may lead to the evolution of an entirely new technique.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0012, SYNCHRONOUS ENVIRONMENT SPECIFICATION

H.B. Garrett, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF249050)

AF function - AF communications satellites at synchronous orbit are degraded by satellite charging induced by the plasma environment. Deficiency - the space environment during periods of satellite charging is not sufficiently defined. Objective - to plan for and conduct a rapid interpretation of the environmental data returned by the SCATHA satellite in conjunction with the SCATHA engineering sensors so that adequate design criteria might be developed to prevent degradation of future satellite communications systems. How research contributes -understanding of the satellite charging phenomenon is necessary so that steps may be taken to prevent damage to satellites from electrostatic discharges (ESD). Knowledge of the geosynchronous environment is needed to interpret the causes of spacecraft charging and to complement efforts aimed at computer simulations of the spacecraft-environment interaction.

Data from the ATS-5 satellites will be analyzed to produce an environmental atlas. This atlas will consist of a statistical description of the ambient geosynchronous plasma. Plans will be made to incorporate the SCATHA (satellite charging at high altitudes) satellite data into a final comprehensive specification of geosynchronous and near-geosynchronous plasma environment. This final atlas will be the basis of a statement to be included in AF contractor's SOW's.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0013, RELATIVE DURATION OF SPORADIC E VERSUS DISCRETE AURORAL EVENTS

A.P. Krukonis, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF580980)

AF function - communication, radar, navigation and surveillance. Deficiency - the polar ionosphere is presently very unpredictable to such a degree that the above functions are frequently degraded or crippled. Objective - to define the durations of discrete auroral events via sporadic e. How research contributes - the ionospheric environment affects AF ground and airborne communications and surveillance systems. Accurate specification of the relationship of the interaction of ionospheric sporadic e and auroral temporal and spatial effects will contribute to the reliable operation of the AF communication and surveillance functions.

Gather and interpret ionosonde sporadic e data collected on selected flights of the AFGL Airborne Ionospheric Observatory, NKC-135 aircraft number 53131, from the AFGL Goose Bay Ionospheric Observatory and other ground-based ionospheric stations. Analyze related ASCA photographs for duration of short-term auroral activity. Investigate relationship between duration of discrete auroral events and sporadic e to model temporal and spatial changes between 'anchor-point' determinations of e-region characteristics.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0014, COMPARISON OF ROCKET AND DMSP DENSITY DATA

C.R. Philbrick, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF581230)

AF function - low-altitude operational satellites, airborne surveillance and ballistic weapon delivery. Deficiency - inadequate density data base at critical altitudes. Require improvement in computational accuracy of ephemerides for low-altitude operational satellite and ICBM trajectories. Objective - provide calibration data for DMSP satellite with onboard SSD package used to determine density on a global scale. How research contributes - in situ rocketborne density measurements made during satellite pass will enable significant intercomparison of observations to be made with the remote sensing technique of the supplementary density sensor (SSD).

PZL densitometer (10 inch falling sphere) payloads will be launched at an appropriate time during a pass of a DMSP satellite with an onboard SSD package for remotely sensing density. Near simultaneous rocketborne measurements of composition, optical emissions and solar EUV will also be made and the acquired data will be analyzed to assist in the evaluation of data from the DMSP/SSD package and to study the thermospheric heating sources and energy balance.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0015, CODE SENSITIVITY STUDIES FOR PHOTODETACHMENT AND PHOTODISSOCIATION

G.T. Best, University of Lowell, Graduate School, *Lowell, Massachusetts* 01854 (DF248450; F19628-76-C-0295)

AF function - nuclear weapons effects, nuclear weapons delivery, intercept weapon delivery. Deficiency - radar and communications blackout following nuclear detonations cannot be accurately predicted. Objective - to determine the sensitivity of the AFGL/Keneshea photochemistry computer code to variation of the rates of photodissociation and photodetachment for important atmospheric negative ions. How research contributes - provides information on the overall importance and accuracy required for photodissociation and photodetachment processes in predicting the temporal and spatial extent of blackout from natural and nuclear perturbations of the atmosphere.

A survey will be made of available information on the identity of and the rates of photodetachment and photodissociation for important negative ions in the atmosphere. Study will then be made of the effects of photodetachment and photodissociation upon atmospheric ion composition and electron density as determined by varying the rates for these processes as input parameters in the AFGL/Keneshea photochemistry computer code. The variation of free electron densities predicted by the code will then be correlated with existing ionosonde measurements following magnetic storms and pronounced auroral activity.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0016, ENGINEERING AND INSTRUMENTATION SUPPORT FOR ROCKET AND BALLOON LAUNCH OPERATION

R.A. Bumgarner, New Mexico State University, Las Cruces Campus, School of Arts & Sciences, Dept. of Chemistry, *University Park, Las Cruces, New Mexico* 88003 (DF247520; F19628-76-C-0171)

AF function - command, control and communications. Deficiency -reduced effectiveness for supporting research rocket firings at WSMR and research balloon launches at Holloman AFB. Objective - to provide effective engineering and instrumentation support during the launching of scientific rocket and balloon payloads at WSMR and Holloman AFB. How research contributes - the instrumentation systems developed allow the aerospace investigations to be conducted on a timely and cost-effective basis. Projects depending on this research include 1366, 6687, 6688, 6690, 7659, and 7670.

The technical approach includes integrating range safety, tracking and recovery systems into rocket payloads to be launched in support various scientific programs. A telemetry facility will be maintained and operated to provide for the prelaunch testing of the instrumented research rockets to be launched at WSMR. Approach also provide for equipment calibration and data analysis during balloon launches at Holloman AFB, New Mexico. Coordination will be provided between the instrumentation engineers and the launch sites to satisfy documentation or other technical interface requirements.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0017, ATMOSPHERIC MEASUREMENTS DURING 1979 SOLAR ECLIPSE

F.E. Niles, U.S. Dept. of Defense, Army, Electronics Research & Development Command, Atmospheric Sciences Lab., *White Sands M.R., Las Cruces, New Mexico* 88002 (DA0F1771)

The technical objectives are quantitative descriptions of the negative ions, positive ions, and electrons - their identities, concentrations and time histories, as the solar forcing function (ionization, dissociation, and detachment) changes during passage of the moon's shadow as a partial simulation of nuclear weapons effects on the atmosphere. Section 9 of the Army Qualitative Research Requirements for Nuclear Weapons Effects Information documents the requirements for the investigation of natural atmospheric events which simulate nuclear weapons effects in connection with Army communications and ballistic missile defense.

A detailed experimental plan involving interagency and international experimenters will be formulated and executed for experiments to be conducted during the total solar eclipse of 26 February 1979. The experiments will focus on the measurements of atmospheric response to the eclipse in the 60-90 kilometer altitude region but with extension to as low an altitude as possible. Principal attention will be directed to rocket-borne experiments, but consideration will also be given to ground-based, airborne and satellite measurements which can contribute to the basic experimental objectives.

SUPPORTED BY U.S. Dept. of Defense, Electronics Research & Development Command, Atmospheric Sciences Lab.

5.0018, DEVELOPMENT OF IMPROVED METHODOLOGY FOR INVESTIGATING WILDLIFE POPULATIONS AND WETLAND HABITAT

D.S. Gilmer, Northern Prairie Wildlife Research Center, *P.O. Box 1747, Jamestown, North Dakota* 58401 (86710-903)

Management of wildlife populations and habitats must be based on sound biological and ecological research. Much research intended to determine the wildlife responses to management practices often falls short because the methodologies and techniques for estimation of biological and ecological parameters are inadequate or inaccurate.

The objective of this project is to develop, modify, improve, and evaluate various research techniques to provide more reliable and unbiased data for investigating wildlife populations and wetland habitats. The approach is to apply the most sophisticated and innovative technologies available to these studies, including the use of satellite and airborne remote-sensing techniques and radiotelemetry equipment. Statistical sampling strategies and computer simulation modeling will also be employed to study diverse species of wildlife. Target species in the current studies include the ferruginous hawk and the mallard duck.

SUPPORTED BY U.S. Dept. of the Interior, Fish & Wildlife Service, Div. of Wildlife Research

5.0019, TRACE GAS MEASUREMENTS IN THE GAMETAG EXPERIMENT

R.A. Rasmussen, Oregon Graduate Center, Graduate School, Dept. of Environmental Technology, *19600 N.W. Walker Rd., Beaverton, Oregon* 97005 (ATM78-09711)

The objectives of this research are: (1) to continue measurements of the concentration distribution of CO, CH3Cl, CHCl3, CH3Cl3, CH4, freon-11, freon-12, and N2O as a function of latitude and altitude on the GAMETAG flight program; (2) to collect large volume cryogenic air samples to better characterize the concentrations of other trace gases; and (3) to increase intercalibration efforts among several laboratories involved in the GAMETAG program. The data to be obtained will be used to improve understanding of the role of OH in tropospheric chemistry and to provide for better assessment of global trospospheric budgets. This experiment is an important component of an integrated package of experiments being conducted aboard the NCAR Electra aircraft. These measurements are the most extensive observations ever attempted of atmospheric trace gas concentration distributions.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0020, LIDAR MEASUREMENT OF BOUNDARY LAYER WINDS AND CONVECTIVE STRUCTURE 13535-GS

E.W. Eloranta, University of Wisconsin, Madison Campus, School of Letters & Science, Dept. of Meteorology, *500 Lincoln Dr., Madison, Wisconsin* 53706 (DA0E9033; DAAG29 76 G0156)

To study convective structure and remotely determine winds in the planetary boundary layer under a variety of meteorological conditions, and compare lidar derived winds with conventional derived winds. Real-time wind measurements and investigation of convective structure of the lower atmosphere are needed to support (1) the wind correction for atmospheric general purpose rockets under development and older systems in operation; (2) the transport and diffusion research at Dugway Proving Ground; (3) aircraft landings and takeoff; and (4) the forecast of local weather conditions.

Simultaneous atmospheric measurements using high spatial and temporal resolution monostatic lidar, a miniature radiosonde, and acoustic sounder, and an 86 meter tower instrumented to measure sensible heat and momentum fluxes. Obtain lidar wind under a variety of meteorological conditions and study convective structure revealed by aerosol density inhomogeneities.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

5.0021, LOW-LEVEL MONSOON WIND DYNAMICS

J.A. Young, University of Wisconsin, Madison Campus, School of Natural Sciences, Dept. of Meterology, *Agriculture Hall, Madison, Wisconsin* 53706 (ATM7825503)

The object of this research is to carry out a sequence of observational, modeling and theoretical studies directed toward development of a unified understanding of monsoonal flows in the lower levels of the atmosphere. Special emphasis will be given to conducting unique satellite and aircraft observations of planetary boundary layer flow over the Arabian Sea during the GARP Monsoon Experiment (MONEX) in the summer of 1979. The satellite is a U.S. geostationary satellite that will be over the Indian Ocean in 1979. The aircraft observations will be made from the National Center for Atmospheric Research's (NCAR's) aircraft the Electra, on which the P.I. will be one of the principal scientists.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0022, NAVY ENVIRONMENT - STRATOSPHERIC CONSTITUENTS (PAM)

T.J. Pepin, University of Wyoming, School of Arts & Sciences, Dept. of Physics, *P.O. Box 3435, University Station, Laramie, Wyoming* 82070 (DN223438; N00014-75-C-1180)

The objective of this research is to determine reference levels of aerosols in the stratosphere for the purpose of eventually determining the environmental impact of Navy high-performance aircraft on the stratosphere.

This research will involve a solar extinction experiment on a SAMSO satellite to determine globally, or hemispherically, the distribution of stratospheric aerosols. The experiment measures solar extinction at various satellite sunrise and sunset angles. From this measurement aerosol loading of the stratosphere can be determined. The resultant data will be processed to show monthly and seasonal values of particulate concentrations in the stratosphere.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0023, SOLAR RADIO PATROL - MANILA

V.L. Badillo, Manila Observatory, *Manila, Philippines* (DF260080; F19628-77-C-0200)

AF function - communications, surveillance and navigation. Deficiency - disruptions in communications systems due to solar-induced ionospheric disturbances. Lack of capability to predict interruptions to communications, false alarms in surveillance systems from natural causes, and navigation errors. Objective - to develop and interpret solar signatures of the onset of proton activity in the earth's atmosphere. How research contributes -

makes reliable real-time information available to operational USAF groups. The primary purpose of this contract is to use data collected at Manila Observatory in solar-radio-optical, ionospheric and geomagnetic areas to interpret the time history of energetic particle emission.

Improve upon earlier AFCRL-established criteria of quantitative relationships between radio and particle flux densities. A useful data input will be more burst spectral data from high frequency monitors. To this end present patrols will be augmented by a 15 gHz patrol. Criteria for non-typical proton events will be sought in burst and burst region parameters. The contract will continue to develop a better understanding of the relation between solar emission and ionospheric variations.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0024, TROPO-STRATO TIDAL INVESTIGATION

G.V. Groves, University of London, University College, *Gower St., London, England, United Kingdom* (DF582080; AFOSR-77-3224)

AF function - prepare environmental assessments of systems that may contribute to the pollution of the stratospheric environment. Opportunity - improvement of an understanding of the dynamics of the stratospheric processes. This work will identify sources of dynamic motions in the stratosphere. Objective - interpretation of atmospheric tidal patterns to define the tropospheric and stratospheric generating sources. How research contributes - better understanding of stratospheric dynamics will allow more accurate prediction of the horizontal and vertical extent of the growth of pollutants injected into the stratosphere their persistence and transport mechanisms. An accurate understanding of stratospheric dynamics is essential to the preparation of inputs for environmental impact statements.

Observational data from diurnal rocket grenade experiments will be analyzed for short-term variations in tidal patterns. General theory and analytical techniques will be developed to enable the sources of generation from observed tidal patterns. This is a complex inverse problem of the well-developed classical Chapman-Lindzen tidal theory. Specific investigations will include (a) the propagation of atmospheric tides by specified sources of generation such as heating, (b) the resolution of diurnal and semi-diurnal components from wind and temperature observations and, (c) deducing the properties of generation sources by working back from observed tidal motions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0025, VISIBILITY WITHIN AND ELECTROMAGNETIC TRANSMISSION THROUGH NATURAL CLOUDS AND FOGS

J. Latham, University of Manchester, *Oxford Rd., Manchester, England, United Kingdom* (DF580090; AFOSR-78-3511)

AF function - target acquisition and tracking reconnaissance. Deficiency - the performance of optical systems looking through the atmosphere is significantly degraded by absorption and scattering by fog and cloud particles. Research - field measurements of spatial and temporal variations of visibility, liquid water content, droplet size distribution and 10.6 micrometer laser transmission in natural clouds and fogs at Great Dunn Fells in Cumbia, England. How research contributes - results will be applicable to the solution of such problems as atmospheric contrast reduction, sky background radiance, out-of-beam scattering and propagation breakdown of laser radiation. Models of atmospheric transmittance will become more specific for different types of environments.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, F-4E MODEL/PROBE VISUAL SYSTEM APPLICATION

P.E. Grunzke, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Williams Air Force Base, Chandler, Arizona* 85224 (DF221100)

The purposes of this effort are: (1) to evaluate the LOGICON Automated Flight Training System (AFTS), and (2) to evaluate the utility of a model/probe visual system in F-4E training.

As directed by the USAF air staff, TAC and AFHRL/FT are developing a utilization concept for F-4E WSTS No. 18. The simulator system is being refurbished at Singer-Link, with a six-degree-of-freedom motion system and a model/probe visual system. Upon completion, the system will be installed and an evaluation of the training utility of the device will be conducted. The LOGICON AFTS will be evaluated using F-4E WSTS No. 15.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0002, KC-135 WST VISUAL SYSTEM EVALUATION

J.A. Thorpe, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Williams Air Force Base, Chandler, Arizona* 85224 (DF223460)

To compare the training effectiveness of the three types of flight simulator visual systems (day/night color computer generated image (CGI), night only/point light source CGI, and TV-model board) for use in KC-135 combat crew training school (CCTS). The results of this comparison will impact the decision to procure a visual system for three CCTS simulators. This investigation will (1) study in depth the role of a visual system for tanker-transport-bomber (TTB) flight simulators, (2) determine instructional strategies best suited for such a device, and (3) develop innovative techniques to maximize training in the CCTS.

Three groups of ten KC-135 student copilots from CCTS will receive specialized training in simulators equipped with one of the three visual systems of interest. Following simulator training, each copilot will fly the aircraft and transfer of training will be assessed. Student copilots will be used instead of pilots upgrading to the aircraft commander crew position since it is expected that the less experienced student copilot will show the most learning during simulator training. The task to be trained will be the visual flight rules (VFR) traffic pattern because it is the most visually dependent task flown in the KC-135. Therefore, it is the task which exercises the visual system to the greatest degree. The utility of a side window as well as a forward window will be assessed by training all students to fly left hand traffic patterns from the left seat. This restriction for left seat training exists because of hardware availability - the TV-model board system, as it is currently configured, can only display a side field of view from the left seat. Therefore, all three simulators will be configured for left window-left seat student training for standardization.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0003, VCASS HELMET-MOUNTED DISPLAY DESIGN

R.A. Buchroeder, University of Arizona, Graduate School, *Tucson, Arizona* 85721 (DF324310; F33615-78-C-0520)

The objective of this program is to accomplish an optimized system design for an extremely wide field-of-view (FOV), virtual image, head-coupled display system for the visually coupled airborne systems simulator (VCASS) program. This device will be utilized in conjunction with head and eye position sensing mechanisms and computer generated-imagery subsystems to develop a wide FOV virtual scene simulator for engineering and training simulation applications.

The approach will be to develop a weighted matrix using appropriate analytical techniques which gives in an engineering sense a figure of merit when related to the specified design criteria. When the matrix has been completed and design criteria are set, a comprehensive study of potential design approaches will be made. The design approach which appears most promising will be selected for detailed analysis. Finally a detailed technical specification complete enough to allow fabrication of the design by any knowledgeable manufacturer of optics and display systems will be prepared.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0004, HUMAN PERFORMANCE EVALUATION OF MATRIX DISPLAYS

L. Scanlan, Hughes Aircraft Co., *Centinela Ave. & Teale St., Culver City, California* 90230 (DF319800; F33615-76-C-0503)

The objective of this effort is to provide a comprehensive experimental evaluation of advanced matrix display technology in terms of the simulated image display parameters involved and their effects on human performance. In addition, evaluation techniques will be developed for quantifying and subsequently specifying the characteristics of matrix element displays. The functional relationships and techniques to be generated will provide the developers and users of advanced display media with critically needed design criteria and trade-off data to optimally implement this new matrix display technology.

A simulation will be developed which will allow a wide range of variables associated with matrix element displays to be evaluated in terms of angular subtense of targets at time of recognition. Response surface methodology will be employed to determine the effects of existing and projected state-of-the-art combinations of display parameters to achieve alternative levels of operator performance.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0005, ISD APPLICATION STUDY

J.R. Swink, Logicon Inc., *21535 Hawthorne Blvd., Torrance, California* 90503 (DF222790; F33615-77-C-0034)

To identify and document problem areas encountered in the application of ISD procedures to flying training programs and develop alternative plans for dealing with the problems so as to optimize implementation of Air Force ISD program.

This study will be conducted in five phases. In Phase I the contractor will refine and add detail to the research plan developed in the proposal. In Phase II the contractor will visit operational ISD units to collect data related to successes and problems in the application of ISD methodology. Phase III (synthesis and analysis) will include a review and analysis of ISD documentation, categorization of problems and successes, identification of common and uncommon problem areas across commands, and a full and clear description of the problem. Phase IV will develop an array of alternative plans for solving the problems identified during Phase III. In Phase V, the contractor will submit a technical report to the entire study project to include a revised report of alternative solutions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0006, ISOLATION OF CIRCULATORY INFLUENCE IN HIGH STANDARD GRAVITY

R.E. Burger, University of California, Davis Campus, School of Agriculture & Environmental Sciences, Dept. of Avian Science, *Davis, California* 95616 (DF049870; AFOSR-77-3430)

AF function - the Air Force operational environment involves exposure to a wide variety of mechanical forces including high sustained acceleration (HSG). It has been recognized that cardiovascular responses can be encountered which may be particularly important in determining performance capabilities in aircrew members. Deficiency - exposure to high sustained acceleration (HSG) produces myocardial pathologies in small mammals. Both subendocardial hemorrhages and cardiac myopathies have been observed in swine subjected to acceleration stress. Recently, similar pathologies have been discovered in avian species, suggesting an interspecies response and providing an excellent model for study. The possibility exists that man subjected to extreme acceleration stresses, as in the new maneuverable fighter planes, may be developing similar cardiac myopathies. The cause of these damages deserves investigation. Objective - this study will evaluate the component of arterial hypoxia in susceptibility to HSG, using domestic fowl as subjects. One can artificially maintain oxygenation via a catheter inserted into the air sac, a procedure that is not compatible with the thoracic respiratory system of mammals. This procedure removes ventilatory impairment as a factor determining response to HSG. How research contributes - this research will complement ongoing exploratory work at USAFSAM dealing with the effects of HSG on the cardiovascular system, with emphasis on 'g' induced cardiomyopathy. It directly supports subarea 1.6, 'Habitable Crew Environments in Air Force Operations.'

Estimate oxygen metabolism as a measure of circulatory impairment and potential myocardial susceptibility to HSG, calculate mixed venous oxygen concentration to aid in assessing perfusion abnormalities, determine R.Q. which will indicate the presence of absence ventilation perfusion inequalities, and estimate the contribution of arterial hypoxia on myocardial pathology.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0007, MECHANISMS OF SPINAL FAILURE

T. Belytschko, Northwestern University, Evanston Campus, Technological Inst., Dept. of Materials Engineering, *633 Clark St., Evanston, Illinois* 60201 (DF323250; F33615-77-C-0526)

This effort will provide an injury prediction capability for the head-spine computer-based model previously developed under AMRL/BBM sponsorship. This capability is necessary to provide design criteria and evaluation techniques for aircraft emergency escape systems and operational procedures. The effort involves the generation of injury criteria from structural analysis of the elements of the spine, and the incorporation of these injury criteria into the total head-spine model. The final product will have applicability to Air Force problems related to emergency escape from aircraft, aircraft crashes and gross impacts to the head and/or torso.

Structural analyses of vertebral elements will be performed using finite element, or equivalent, methodology and failure-level criteria based on these analyses will be established. The modes of failure to be considered will be those observed from military flight operations, and additional ones which may be anticipated from the operational characteristics of future manned military flight systems. The structural analysis will be performed on the elements of both human and chimpanzee spines. The developed local criteria for failure will be incorporated into the total head-spine model in such a manner as to provide probabilities of failure at every local site considered for a total body impact exposure.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0008, PERSONNEL TECHNOLOGY - DETERMINATION OF FUNDAMENTAL CHARACTERISTICS OF VISUAL SYSTEM FUNCTIONING AND INFORMATION PROCESSING

J.L. Brown, University of Rochester, Center for Brain Research, *River Campus Station, Rochester, New York* 14627 (DN623811; N00014-76-C-0189)

Determination of the effects of varying degrees of illumination, from very low to high intensity flash, on the effectiveness of visual information transmittal from naval aircraft and ship displays continues to be significant to accomplishment of the Navy's mission. This work unit is concerned with the study of aspects of pattern discrimination, color discrimination and visual acuity as they are relevant to the design and improvement of instruments for the visual display of information.

Planned research includes continuation of (1) psychophysical studies in man on the temporal and spatial resolution of the visual system, (2) electrophysiological studies in animals attempting to relate activity at various points in the visual system and cortical activity, and (3) development of an objective and rapid procedure for evaluating the presence and extent of color deficiency in humans.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

6.0009, INSTRUCTOR/OPERATOR STATION DISPLAY SYNTHESIS STUDY

N.D. Geddes, Systems Research Lab. Inc., *500 Woods Dr., Dayton, Ohio* 45432 (DF228590; F33615-78-C-0017)

To develop and apply methods and guidelines for synthesizing instructor/operator station (IOS) displays for flight simulators. The purpose is to devise an optimized method for producing display designs based on known or theorized limitations and other characteristics of the user's ability to perceive, integrate and utilize data from several different inputs simultaneously.

A design methodology will be developed for synthesizing IOS displays. The types of information to be displayed, as well as alternative ways of displaying it, will be identified and categorized. User limitations and other characteristics will be identified and used to develop a defendable set of guidelines for use in designing IOS displays. From these guidelines, a theoretically optimum IOS display design method will be developed and tested on two (2) sample IOS display synthesis problems. The resulting method will be used to develop advanced IOS displays.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0010, APPLICATION AND REFINEMENT OF VISUAL SYSTEM MODEL

M.W. Cannon, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF323810)

The objective of this work unit is the development of a predictive model of the human visual system and its application to the solution of Air Force problems in the following areas: (1) The development of a predictive model of human visual performance at selected visual recognition tasks such as alphanumeric symbol-set recognition or target recognition against a cluttered background. Such a model has great value in eliminating the need for time-consuming, expensive psychophysical testing to evaluate the fidelity of various display systems and the recognizability of various symbol fonts used in cockpit displays. (2) The development of bandwidth reduction schemes for image transmission optimally matched to the human visual system. (3) The development of size- and form-sensitive filters for target cueing or automatic target recognition.

The present algorithms for predicting human form recognition and similarity judgments will be tested against results of psychophysical experiments, in-house and from the literature, with emphasis placed on the evaluation of symbol-set recognizability and the development of a windscreen distortion measure. Bandwidth compression studies using various spatial frequency filters will be implemented on the AMRL/BBM pattern recognition facility and the usefulness of these filters will be tested by psychophysical experimentation on the filtered imagery. Results from this study will lead into the development of feature extraction filters for target cueing and automatic target recognition. The model itself will be continually improved by incorporation of pertinent results from the literature and from work unit 71842502, Visual Processes of Complex Imagery, being conducted by Miami University.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0011, DISPLAY/OBSERVER INTERFACE FOR TARGET ACQUISITION AND WEAPON DELIVERY

A.P. Ginsburg, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF320980)

This effort will provide a source of highly calibrated (digitally created) stimulus materials for basic and applied research. It will serve to translate basic visual system characterizations and perceptual demand data into design criteria for visual display systems. An overall quantitative model (being developed under work unit 2313V122) will be exercised to evaluate the ability of the observer to acquire and process visual information under various conditions of display image quality, task criteria, and loading. Predictive applications of the model will be extended as empirical data bases are identified and/or developed. Emphasis will be on defining image content, combining display quality and target detail. The products of this effort will include precisely calibrated stimulus sets, definition of the psychophysical correlates of displayed imagery enhancement, and validation of advanced target acquisition concepts.

The Human Engineering System Simulator (HESS) will be expanded to provide capabilities for digital quantization of video and film recorded images. Modular image processing and utility software will be installed/developed to support two-dimensional Fourier transformation and filtering operations of simple and complex scenes. Sequences of processes, corresponding to atmospheric, sensor, and visual perceptual functions will be structured. Processed imagery will be reconstructured on high-resolution hardcopy or softcopy displays.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0012, NO PATHOLOGY THRESHOLD

A. Hall, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF320470)

To develop nationally recognized data on chronic inhalation exposure effects of volatile Air Force chemicals and to provide safe occupational exposure limits (threshold limit values) which constitute concurrence with the Occupational Safety and Health Act as directed by Executive Order. The NO pathology threshold portion of job order number 63020620 has been transferred to this new work unit.

To establish an acceptable, non-injury concentration of Air Force chemicals under subacute and chronic exposures for the primary target organs. The methods used will be gross, light microscopy, and electron microscopy of animal tissues exposed to the test chemicals. hematological, clinical chemistry, microbiological, and immunological findings will be evaluated. Stringent quality control on animals used in subacute and chronic toxicology studies will be maintained. The data and recommendations for safe exposure level are provided the Air Force Surgeon General and the National Academy of Sciences Committee on Toxicology to obtain approved exposure criteria.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0013, HUMAN CAPABILITIES IN INFRASOUND

D.L. Johnson, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF321360)

Various AF noise environments contain high-intensity acoustic energy in the frequency range below approximately 16 Hz (infrasound). Although this very low-frequency energy has little effect on hearing, it may adversely influence physiological functioning, psychomotor and cognitive performance. The objective of this research is to systematically investigate the effects of infrasound exposures on the capabilities of human subjects to perform selected tasks. The threshold of these effects, the nature and extent of the interference and the overall performance limits will be defined in terms of the acoustic exposures. This effort will provide support for the whole body exposure effects standards sections in AFR 161-35.

The approach is to systematically examine the effects of infrasound on a variety of tasks, performed by human volunteers, that might show differential effects due to the very low-frequency energy. The nature and difficulty of the tasks (psychomotor, visual search and cognitive) will be varied together with the frequency, duration and intensity of the infrasonic stimulus in an effort to identify variables in the stimulus, task or subject that might result in reduced human capabilities. A substantial technology base describing human performance in infrasound will be realized when these results are integrated with those from earlier efforts. This work is possible only because of the unique dynamic pressure chamber at AMRL.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0014, MEASUREMENT OF WHOLE BODY INERTIAL AND KINEMATIC RESPONSE

J.P. Kilian, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF322740)

The mechanical and dynamic properties of aircrew members are not sufficiently defined to allow an adequate determination of the effect a crew member, seat occupant, may have on the overall performance of an escape system. For example, the designer is unable to determine the effectiveness of ejection seat trajectory divergence techniques required to avoid collisions during escape from multiplace aircraft such as the B-1, TF-15, and F-16B. Aeromedical data that are required include human body center-of-gravity, moments of inertia, aerodynamic properties and dynamic inertial response characteristics. The objective of this effort is to measure the inertial response of the human body under short-duration acceleration conditions such as those experienced during emergency escape.

Impact tests will be accomplished using volunteer human subjects and special anthropomorphic dummies. Inertial and kinematic responses will be measured using accelerometer, force cell and photometric techniques. Initial testing will be done in the sideward direction (gx) using varied levels of body support and restraint. Phase II of the effort will concentrate on the measurement of whole body and body segment responses in the plus gx direction. Final phases will focus on combined plus gz and minus gx acceleration profiles. Data will be incorporated into a mathematical model which will predict the dynamic response of the total human body under any acceleration condition generated during emergency escape. Static inertial properties of the human body determined under another work unit will also be incorporated into the model to provide a more comprehensive understanding of initial body position and anthropometric variations within the flying population. The technology will be provided to the Air Force Flight Dynamics Laboratory and the aerospace industry for use with multidegree-of-freedom escape system computer models.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0015, VCASS LABORATORY SYSTEMS DESIGN/INTEGRATION

D.F. Kocian, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF321150)

To perform the systems analysis and design of the overall visually-coupled airborne systems simulator (VCASS), including the visually-coupled systems (VCS) components (helmet-mounted sight/helmet-mounted display), scene/graphics generators, and crew station, computational, software data base subsystems. To specify the configuration of VCS and scene generation components to be developed on contract. To integrate these components into a laboratory systems demonstration of the VCASS concept. The ultimate product of this program will be an extremely cost-effective, high-fidelity visual scene simulation capability to be utilized for engineering design as well as training applications. This effort supports AFSC development goals TC-2, TC-4, TC-5, MS-4, and TN-1.

The overall VCASS effort will exploit the unique capabilities of the visually-coupled system (helmet-mounted sight/display) technology in order to provide a self-contained ground/airborne man-in-the-loop visual display scene simulator for performing man-machine interface design and engineering of cockpit control/display subsystems. Initially, an interim laboratory demonstration capability will be developed by integrating existing helmet-mounted sight and display components into a cockpit mockup with an interface to a programmable symbol generator. A demonstration will then be performed to show the conceptual use of the VCS as a hemispherical headup display. Psychophysical studies will be conducted to determine the critical vcass design factors such as the required instantaneous field-of-view of the helmet-mounted display, display update rate, angular resolution/update rate of the helmet-mounted sight and trade-off between monocular versus binocular display viewing. As a result of these findings, advanced VCS components will be specified and developed through separate contractual efforts. Simultaneously, a comprehensive systems analysis and system design will be performed for developing an advanced laboratory demonstration of the VCASS concept.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0016, ELECTRONIC WARFARE CREW STATION DESIGN AND PERFORMANCE ASSESSMENT

E.D. Sharp, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF316620)

The objective of this work unit is to integrate B-52 electronic warfare (EW) crew station design with emphasis on improving the utilization and effectiveness of the operator as part of the weapon system. In-house and contractual efforts through real-time simulation yield control display criteria for specific designs, overall crew station designs and technology advancements suitable for future applications.

The approach to this effort is to make maximum use of real-time, man-in-the-loop simulation to define, quantify and analyze operator performance in present and future EW crew stations, establish criteria for control display layout system integration and crew performance workload and workload distribution. Controlled mission conditions will be simulated to investigate systematic changes in crew station designs with respect to overall workload and operator performance as a result of the addition of prototype systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0017, METABOLISM OF HYDRAZINE

F.N. Dost, Oregon State Higher Education System, Oregon State University, School of Agriculture, Dept. of Agricultural Chemistry, *35th & Jefferson Sts., Corvallis, Oregon* 97331 (DF320680; F33615-77-C-0500)

Research is needed to characterize metabolic pathways of potential Air Force pollutants in selected animal species to provide data for estimating if man metabolizes compounds similar to specific animals. Metabolic pathways must be identified for risk prediction on potential chemical oncogenic compounds. In particular, the biological effects of hydrazine exposure have been and are being extensively investigated, but the metabolic disposition of at least 50 percent of administered hydrazine is still unknown. The specific objective is to study the metabolic fate of the missile propellant hydrazine to aid in a better understanding of the oncogenic potential of the compound. The data will also help to develop toxicity criteria for the USAF as required by AFR 19-1.

The research proposed here is first intended to account for all hydrazine nitrogen administered, by determining the amount of hydrazine nitrogen that appears in respiration, urine and tissues as hydrazine, N2 and ammonia, and other metabolites. The potential for formation of certain probable intermediates, particularly diimide, will also be studied. The investigation will utilize the rat as the primary research animal while various chemical analyses and mass spectroscopic measurements of 15 N from 15 N-hydrazine will be employed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0018, GENETIC BASIS OF CRESOL BIODEGRADATION IN BACTERIA

H.D. Cobb, Trinity University, Graduate School, Dept. of Biology, *715 Stadium Dr., San Antonio, Texas* 78212 (DF041200; AFOSR-76-2875)

AF function - the Air Force uses large quantities of carbon removing and paint stripping compounds (ortho-dichlorobenzene and cresol), particularly at aircraft engine overhaul facilities, thereby concentrating the problem of degradation and disposal so as not to interfere with many forms of aquatic life due to the toxicity of these disposal products. Investigators will be concerned with the examination of basic molecular factors involved in cresol degradation. Deficiency -no satisfactory substitute compounds

are available and no effective degradation or detoxifying process exists. Objective - the long-range goal of this research effort would be to use the information gained from these proposed studies on cellular molecular organization to develop bacterial strains with greater metabolic stability. The achievement of this goal could greatly enhance the productivity of a waste treatment facility using these bacteria to degrade cresylic acid waste. How research contributes - this work contributes directly to subarea 1.9, 'Environmental Protection and Toxicological Hazards'.

This research will attempt to establish the basic structural elements responsible for the metabolism of ortho-dichlorobenzene and cresol by select bacteria and to determine the metabolic stability of this capability. Specific attempts will be made to determine which fundamental elements are responsible for cresol metabolism and to establish if paracresol utilization is controlled separately from the ortho and meta isomers.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0019, CRITERIA SUITABLE FOR G-SUIT/G-VALVE EVALUATION IN A HIGH G ACM ENVIRONMENT

R.R. Burton, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF322330)

To develop criteria useful in evaluating g-protection resulting from anti-g suits and valves during aerial combat-type acceleration exposures.

Various criteria will be evaluated relative to g-protection provided by anti-g devices during exposure to simulated aerial combat maneuvers (SACM). Criteria to be evaluated will include: (a) objective parameters, (b) subjective measurements, and (c) modeling methods. These criteria relative to various anti-g devices will be evaluated in SACM-types of environments. Significantly correlated experimental criteria with improved g-protection and/or g-tolerances will verify their values as useful techniques in the quantification of anti-g devices used during exposure to aerial combat maneuvers. These criteria will be evaluated using data obtained from: (a) studies primarily designed to obtain these data and (b) studies primarily developed for other reasons--reevaluate data relative to usefulness as a tool to evaluate anti-g devices. These data will be summarized and evaluated in a technical review as the final product.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0020, AEROMEDICAL EVACUATION EQUIPMENT

M. Chandler, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF322090)

To test and evaluate newly developed (commercial or in-house) items of medical material to determine their effectiveness in aeromedical evacuation. The biomedical systems branch has an ongoing program of evaluating medical material items to satisfy identified operational requirements for aeromedical evacuation. Performance criteria have been established to insure that medical equipment items meet stated operational requirements. Current state-of-the-art of medical material technology will be continually assessed.

The test program normally consists of six major areas, patient-user safety, operational specifications, environmental effects, electrical and mechanical characteristics, and human factors. Each area is subdivided into specific engineering tests or evaluations. When the test program is completed, the results are compiled and a report is sent to the field. The information is kept of file and updated or modified as user test reports are received. This is a continuation of part of the work formerly documented under work unit 7755-15-02.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0021, EDG/ERG/DARK ADAPTOMETRY

R.A. Goodwin, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF321690)

To provide comprehensive electrodiagnoistics for night vision evaluation in USAF aircrew members referred to USAFSAM, to gain insight into the processes of night vision disorders through the use of electrophysiology, to advance understanding of basic visual mechanisms objectively with the use of electrical technology.

Application of current technology using using averaging computers, storage oscilloscopes, RF shielded rooms, and other equipment will be continued in evaluating visual physiology. Improved stimuli (integrating spheres) and recording devices (electrodes) will be utilized to advance the quality and scope of collected data. Research into underlying visual mechanisms and processes will be pursued. Efforts previously under work unit 7755-09-04.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0022, EAR LOBE CREASE - RELATIONSHIP TO CORONARY ARTERY DISEASE IN HUMANS

H.H. Hanna, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF321910)

To determine the incidence of significant ear lobe creases in various age groups of selected apparently asymptomatic individuals and to verify the reported correlation of ear lobe creases with coronary artery disease.

Patients referred to the aeromedical consultation service will have a color photograph made of each ear lobe to document the presence or absence of skin creases. In those individuals who later have cardiac catheterization with coronary angiography, correlation of ear lobe creases with coronary artery disease will be determined. Those individuals who do not have cardiac catheterization will comprise the control group for incidence of ear lobe creases. This work was formerly documented under 7755-08-04.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0023, GLAUCOMA/OCUSERT EVALUATION

T.J. Tredici, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF323080)

Work unit 7755-16-03, Glaucoma, defines the broad guidelines to be used for identification, follow-up, and treatment of the majority of USAF flying personnel with glaucoma. This work unit deals with those individuals who cannot be treated with the presently recommended drugs (epinephrine derivatives) or who can no longer be controlled by this medication. Pilocarpine is by far the most useful drug available to control the intraocular pressure. Unfortunately, its side effects (myopia and miosis) preclude its use in flying personnel. Pilocarpine in the new delivery system (Ocusert) has recently been developed by Alza Corporation. It is a controlled release wafer that is inserted into the conjunctival sac and changed once weekly. It is reported to have only minimal visual side effects. If so, this would be ideal for flying personnel in need of treatment for glaucoma.

Glaucoma patients being treated with Ocusert at the Ophthalmology Branch, USAFSAM, referred by flight surgeons or the USAF Surgeon General's office, will be closely followed to assure that the drug does not cause a significant decrement to the visual function. These data will be used to formulate new suggestions and regulations for the treatment of glaucoma in flying personnel.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0024, PHYSIOLOGICAL INFLUENCES UPON THE WORK PERFORMANCE OF MEN AND WOMEN

G.D. Coates, Old Dominion University, School of Arts & Letters, Dept. of Psychology, *5201 Hampton Blvd., Norfolk, Virginia* 23508 (DF050490; AFOSR-78-3512)

AF function - Air Force operations expose aircrew members and other support personnel to a wide variety of environmental stress factors which include fatigue, unusual work cycles, thermal

stress, etc. These factors may affect military performance to a degree that would limit an individual's effectiveness in a man/machine system. The results of these studies should provide carefully controlled, quantitative laboratory assessments of women's performance under standard and nonstandard work conditions as a member of the military team. A comparison of data from the proposed study and data already collected on males will provide crucial information concerning any differences between homogenous crews of females as compared to males. Deficiency - as more and more women occupy operational positions, a data base on their physiological capabilities and limitations is required. Objective - this effort will explore the effects of the ovarian cycle and the sex of the subject on work performance. The primary focus of the research is on the effects of ovarian cycling on the work performance of women, including an assessment of the interactive effects of menstruation with a stressor known to produce decrements in work performance, continuous work, and consequent sleep loss. Comparison of the data obtained on female subjects to that of other studies using male subjects employing the same work situation, previously conducted by personnel of this laboratory, will permit some assessment of the effects of sex on work performance as well. How research contributes - this research contributes directly to RO 1.5, 'Aerospace Medicine' and RO 1.6, 'Habitable Crew Environments in Air Force Operations'.

The research will be conducted utilizing the standardized procedures of the synthetic-work approach to performance assessment. It employs a Multiple-Task Performance Battery (MTPB) to create within the laboratory a synthetic-work situation in which systematic assessments of work behavior can be made.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, STUDIES ON GOPPA CODES

O. Moreno, University of Puerto Rico, Rio Piedras Campus, Graduate School, *Rio Piedras, Puerto Rico* 00931 (ENG78-16787)

The mathematical structure of a relatively new class of algebraic codes, Goppa Codes, used in communication and computing systems is being studied. Specifically, the following problems on binary, irreducible Goppa Codes with maximal block length are being investigated: (1) The information content of the Goppa codes, (2) New symmetries of Goppa codes, (3) The relationship between symmetries of two different Goppa codes and their error-correcting capabilities, (4) The improvement of the information content of some Goppa codes.

The rate, minimum distance, and methods of improving these codes are sought. Algebraic codes are being employed successfully in some applications including space communications and high-density storage of data in computers.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

7.0002, PROJECT RISK MANAGEMENT PACKAGE (PROMAP)

Unknown, Log An Inc., *924 Westwood Blvd., Los Angeles, California* 90024 (FA78WA-4109; FA161207 (TRAIS NO.))

The contractor shall install and maintain the PROMAP Program in the computer at the Department of Transportation Computer Center (TCC). The contractor shall have qualified personnel available on an 'on-call' basis for interpretation of PROMAP status reports and projections; analysis of alternative courses of action; evaluation of trends; control of schedule and budget; and implementation of final outputs. In the event the TCC computer is unable to meet abnormal turnaround dates, the contractor shall provide pick-up and computer processing of activity data on an 'on-call' basis for these non-routine updates.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

7.0003, GENERAL SIMILARITY SOLUTION OF THE TRICOMI EQUATION AND ITS APPLICATIONS

J.D. Cole, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Mathematics, *405 Hilgard Ave., Los Angeles, California* 90024 (DF046600; AFOSR-77-3173)

AF function - aerospace vehicle design. Opportunity - possibly more economical transonic wing design. Objective - improved analytic techniques for compressible flow problems. How work contributes -numerical parameter optimization is often aided by analytic understanding.

The general similarity solution for a partial differential equation can be found by studying the infinitesimals of the group of transformations which leave the equation invariant. The Tricomi equation is the simplest partial differential equation of mixed type. The four parameter group which leaves the Tricomi equation invariant has been found. It is proposed to study the resulting similarity forms, the geometry of the similarity curves, and to construct the general solution of the ordinary differential equations which result. These solutions can be interpreted as the hodograph streamlines of a transonic flow. Thus new classes of practical flows will be generated by interpretation of particular similarity solutions and their superposition if necessary.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0004, NONPARAMETRIC STATISTICS

M.L. Puri, Indiana University, Bloomington Campus, School of Arts & Sciences, Dept. of Mathematics, *Memorial Hall, Bloomington, Indiana* 47401 (DF042230; AFOSR-76-2927)

AF function - signal detection and communication, meteorology and forecasting airfield ceiling conditions, missile targeting and target localization. Opportunity - continuation of the work in progress by the principal investigator will have far-reaching impact on the above problems. Objective - develop the statistical methodologies applicable to problems in communication theory, signal detection, meteorology and forecasting, target localization and missile targeting. How work contributes - the development of these statistical methods will make available sound and easily implementable theoretical basis for the development of hardware and methods related to the above-mentioned Air Force functions.

Some of the specific areas in which it is proposed to do research are (a) discriminant analysis, (b) some distributions theory problems encountered in the analysis of circular data, (c) asymptotic theory of rank order statistics, (d) development of nonparametric procedures to different classes of stochastic processes, (e) order statistics from the non normal populations, (f) multivariate procedures based on spherical distributions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0005, IMPROVEMENTS TO CDC OFF-LINE MAINTENANCE SOFTWARE AND CDC TEST CART SOFTWARE

G.W. Howe, Raytheon Co., *Boston Post Rd., Wayland, Massachusetts* 01778 (FA77NA-4008; FA160003 (TRAIS NO.))

Design, develop, produce, document, test, and deliver an enhanced Off-Line Maintenance Software (OLMS) Package and an enhanced Test Cart Software (TCS) Package for the CDC System. The initial task for both the OLMS and Test Cart work effort consists of a study phase prior to any program development. The study phases cover an analysis and design effort for the respective software improvements. The end product of the study is to be the generation of a Computer Program Functional Specification (CPFS) defining all improvements to be incorporated into these software packages.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

7.0006, NUMERICAL METHODS FOR PROBLEMS ON ENVIRONMENTAL EFFECTS IN AEROSPACE VEHICLES
R.S. Varga, Kent State University, School of Arts & Sciences, Dept. of Mathematics, *Hilltop Dr., Kent, Ohio* 44240 (DF038960; AFOSR-74-2729)

AF function - the design of chemical laser devices, the study of nuclear weapons effects on structures and aerospace vehicles. Opportunity - the use of Pade approximants to develop computational algorithms for solving the stiff differential equations arising in the application areas listed above may provide useful tools to engineers and scientists in Air Force laboratories. Objective - this research intends to investigate the location of the zeros of certain functions, implicit Runge-Kutta methods for solving still systems of ordinary differential equations, the stability of such methods and to perform numerical experiments with these methods. How work contributes - techniques to be developed under this research effort may lead to the development of effective computational tools.

This research will examine the condition under which certain entire functions contain no zeros in specified parabolic regions in the complex plane. Will determine, if possible, a class of entire functions which with all its partial sums have no zeros in specified infinite regions of the complex plane. Implicit Runge-Kutta methods based on the repeated inversion of a fixed matrix will be investigated. In addition, numerical testing of the techniques developed will be accomplished.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0007, NASTRAN COMPUTER PROGRAM
J.R. Johnson, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF132120)

Structural stength, integrity, service life and minimum weight are vital concerns in the design and analysis of aerospace vehicles to insure that they perform the intended mission. The objective of this effort is to develop efficient general purpose finite element structural analytical methods that will directly support the design and analysis of structures for strategic, tactical, training and logistic aerospace vehicles. The successful accomplishment of this objective will insure the ready capability to provide the analysis support for aerospace systems, such as the B-1, CCV and RPV, with a minimum of elapsed time, and to provide a NASTRAN focal point for the WPAFB NASTRAN users group.

Coordinate the efforts of the users group. Provide consultation and direction as required to use, maintain and modify the computer program. Serve on the HQ NASA NASTRAN Advisory Group (NAG).

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

7.0008, APPLIED DIFFERENTIAL EQUATIONS
M.G. Crandall, University of Wisconsin, Madison Campus, Mathematics Research Center, *610 Walnut St., Madison, Wisconsin* 53706 (DA0M9690; DAAG29 75 C 0024)

Continue and extend studies of differential equations in order to provide a better foundation for the design of Army weapons, vehicles, aircraft, communications and supply systems, and protective equipment. There will be special attention to the influence of boundary conditions on the character of the solutions, special study of the asymptotic behavior of the solutions near singular points, and special attention to other topics from time to time.

A staff of mathematicians who are proficient in this area is regularly employed. A weekly seminar in which problems are discussed and new results are presented stimulates interaction of the members of this group with each other and with interested colleagues from other groups within the Center and with members of other departments. Access to an electronic computer, with programming support, is provided to aid in numerical experimentation.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, THEORETICAL ANALYSIS OF SCATTERING OF A LASER BEAM FROM ROUGH SURFACES 13913-P
C.C. Sung, University of Alabama in Huntsville, School of Science & Engineering, Dept. of Physics, *Huntsville, Alabama* 35807 (DA0F8901; DAAG29 77 G0051)

To obtain surface characteristics such as roughness, curvature and velocity of an object using the coherent radiation of a laser reflected from the surface. Relevance - the research has direct relevance to ongoing work at MICOM on reentry vehicles and reentry vehicle materials and ECOM on battlefield-surveillance, target acquisition and fire control.

Speckle statistics and the relationship between the average angular irradiance distribution of a reflected laser beam to the surface properties of a random rough surface will be investigated.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0002, OPTICAL PROPERTIES OF SMALL BAND GAP SEMICONDUCTORS SUBJECT TO LASER EXCITATION
D.L. Smith, California Inst. of Technology, Graduate School, Dept. of Applied Physics, *1201 E. California Blvd., Pasadena, California* 91109 (DF047320; AFOSR-77-3216)

AF function - aerospace communications, surveillance and detection systems require electrooptical devices which exploit the special properties and interactions of infrared radiation with solid-state materials. Opportunity - materials sensitive in the far infrared region of the electromagnetic spectrum are important components of airborne and spaceborne surveillance systems. Objective - this study investigates the effect of carriers generated by laser illumination on the optical properties of small band gap semiconductors of interest for the construction of infrared sources and detectors, and the behavior of a nonequilibrium distribution of electrons and holes produced in a small band gap semiconductor like Hg1-xCdxTe. More specifically the objectives are to determine the nature of the quantum states formed by optically excited electrons and holes in HgCdTe under different conditions of carrier density and temperature, the energy and lifetimes of these states, the effect of carriers in these states on the electrical and optical properties of the material, and the effect of free holes in Ge on the absorption of intense infrared radiation. How work contributes -infrared detectors and tunable infrared sources of coherent radiation require solid-state materials with narrow band gaps, controlled carrier concentrations and doping to provide optimal performance characteristics. Such investigations should lead to the formulation of models and mechanisms of linear and nonlinear interactions of laser light with solids and the understanding of basic parameters that control the properties and behavior of narrow band gap semiconductors.

(1) Compute oscillator strengths and Auger transition rates for bound excitons in HgCdTe and determine the dependence of these rates on impurity depth and alloy composition. (2) Formulate a theory of the broadening of bound carrier energies due to compositional disorder in semiconductor alloys. (3) Perform high-resolution absorption and luminescence measurements in Hg1-xCdxTe in the composition range (0.25 is less than or equivalent to x is less than or equivalent to 0.45) and the temperature range (4 degrees K is less than or equivalent to t is less than or equivalent to 80 degrees K). (4) Initiate absorption and gain measurements in HgCdTe which is being excited by a high-intensity pump laser. (5) Initiate a theoretical study of saturable absorption in p-type Ge at the CO2 laser frequency.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0003, NUCLEAR TRANSMUTATION DOPING OF GAAS
H. Fritzsche, University of Chicago, School of Physical Sciences, Dept. of Physics, *5801 S. Ellis Ave., Chicago, Illinois* 60637 (DF044190; AFOSR-76-3044)

AF function - microwave solid-state electronic devices are essential components of Air Force surveillance, countermeasure and communication systems. Opportunity - improved performance of devices that generate and process microwave signals can be expected from use of solid-state materials that are more uniformly doped while maintaining low defect concentrations. Objective - the objective of this research is to study a new method of doping high device quality GaAs crystalline materials. How work contributes - this research should perfect a method for preparing high-quality GaAs device material with highly reproducible, homogeneous, and well-controlled doping characteristics.

Pure or chemically doped GaAs will be exposed to a known flux of thermal neutrons. The capture of neutrons by the natural Ga and As isotope, and subsequent transmutation of the radioactive nucleus by beta decay will produce elements which act as donors.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0004, MICROWAVE AND SUBMILLIMETER WAVE INVESTIGATION OF THE DIELECTRIC CONSTANT IN SEMICONDUCTORS WITH SYMMETRY-INDUCED ZERO ENERGY GAP

J.K. Furdyna, Purdue University, School of Science, Dept. of Physics, *Executive Bldg., West Lafayette, Indiana* 47907 (DMR7700034A01)

The objective of this experimental research program is to measure the static dielectric constant of semiconductors with a symmetry-induced zero energy gap, and to determine its dependence on external parameters. In semiconductors belonging to this class the dielectric constant is theoretically predicted to have an anomalous behavior resulting from an inter-band contribution, which in pure materials at very low temperatures approaches a singularity. Microwave and millimeter wave propagation in these materials, in the presence of an external DC magnetic field, is under certain conditions strongly dependent on the static dielectric constant. These wave propagation effects will be used to measure the value of static dielectric field, on composition, on hydrostatic pressure, and on the direction which the magnetic field makes with the crystallographic axes.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0005, LASER LIGHT SCATTERING STUDIES OF EXCITON AND FREE CARRIER RELAXATION IN PURE AND IMPLANTED SEMICONDUCTORS

A.D. Compaan, Kansas State University, School of Arts & Sciences, Dept. of Physics, *Anderson Hall, Manhattan, Kansas* 66502 (DMR7820607)

Experiments to study high-density exciton interactions in ion-implanted Cu2O, previously supported by Grant No. DMR-7600371, will be continued and extended to shorter wavelengths. A high power (100 kw) pulsed dye laser will be used to create exciton densities large enough to observe changes in the photoluminescence spectrum due to exciton-exciton scattering and thermalization effects. This program wll also include resonance Raman studies of other ion-implanted semiconductors such as GaAs.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0006, EXCITED STATE ENERGY TRANSFER PROCESSES AND CHEMICAL REACTIONS

D.E. Pritchard, Massachusetts Inst. of Technology, School of Science, Dept. of Physics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DF042960; AFOSR-76-2972)

AF function - the Air Force is interested in the development of high-power laser technology. Deficiency - techniques are needed for obtaining more detailed information on reaction rates, cross-sections, rate constants, and mechanisms. Objective - a new technique is being developed which permits measurements of the velocity dependence of energy transfer cross-sections of specific excited states. Contribution - this technique will be applicable to measurements on potential laser species.

This research will use a tunable laser to excite molecules to a particular vibration and rotation state and also to select their velocity by means of the Doppler shift. Both the transfer and redistribution of initial translational, vibrational, and rotational energy is studied as these molecules collide with various atomic and molecular targets. This technique also allows the study of electronic orientation-dependent effects in energy transfer collisions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0007, THEORETICAL STUDIES OF MIXED-VALENT SAMARIUM COMPOUNDS, STRUCTURAL AND MAGNETIC PROPERTIES OF ALKALI SUPEROXIDES (ABBREV)

T.A. Kaplan, Michigan State University, School of Natural Sciences, Dept. of Physics, *243 Natural Resources Bldg., East Lansing, Michigan* 48824 (DMR7616597A01)

Research previously supported by DMR7616597.

Theoretical studies of mixed-valent samarium compounds, structural and magnetic properties of alkali superoxides, and strong correlation effects on electronic states in crystalline solids, will be carried out. A variety of calculations will be made and compared with experiments in order to shed light on the microscopic nature of the ground and excited states of the mixed-valent phase of SmS and related compounds. Hopefully the results will explain a number of unusual experimental results, e.g., the neutron form factor and first order phase boundary. The main thrust of the calculations in the superoxides will be to understand the structural phase transitions involving orientational ordering of the O2-molecular ions. Also, the calculations will involve investigation of the effect on the electronic properties of the rich variety of structures observed in these materials. The purpose of the proposed research on strong correlation effects is to investigate a new variational definition of one-electron states (Bloch functions) in crystalline solids for highly correlated narrow-band electrons which overcomes serious deficiencies in earlier attempts.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0008, STRONGLY INTERACTING QUANTUM SYSTEMS

L.M. Sander, University of Michigan, Ann Arbor Campus, School of Engineering, Dept. of Physics, *Ann Arbor, Michigan* 48104 (DMR7825012)

Research previously supported by DMR7412003.

Theoretical work will be carried out in two major areas of solid-state physics: studies of the electron-hole liquid, and general studies of the electron gas in metals. The methods used stem from the density-functional theory of Hohenberg, Kohn and Sham. Particular areas to be investigated are: surface effects in small electron-hole droplets; droplets in doped semiconductor; various aspects of the Wigner and Mott transitions of the electron gas; pseudo-potential theory of metal surfaces; the temperature-dependence of the surface energy of metals; and a possible application of density functionals to liquid helium.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0009, THE ANATOMY OF THE X-RAY AND NEUTRON PRODUCTION SCALING LAWS IN THE PLASMA FOCUS

W.H. Bostick, Stevens Inst. of Technology, School of Engineering, Dept. of Physics, *Castle Point, New Jersey* 07030 (DF028840; AFOSR-75-2754)

AF function - operation of high-altitude vehicles in a post nuclear explosion environment, development of electromagnetic weapons, space and ionospheric communications as well as countermeasures, demand the fundamental understanding of energy transformation processes occurring in plasmas such as magnetic vortex annihilation and emission of photons and particles. Defi-

ciency - the aforementioned information required to design advanced equipment is not available today. Its acquisition may be realized by a well-planned theoretical and experimental research. Objective - this project will investigate both theoretically and experimentally the fundamental characteristics of energy transformation processes. It will specifically study the anatomy of the x-ray and neutron production similarity and scaling laws in the dense plasma focus. Contribution - this work is a part of a comprehensive program of plasma research for the development of an x-ray radiation source for simulation of nuclear weapon effects, the development of advanced electromagnetic weapons (laser and particle beam), the development of space and ionospheric communications, and the development of countermeasures.

This project will perform theoretical and experimental work to understand the energy transformation processes occurring in a dense plasma focus. They will perform the following - a. Measurement of the electron beams and x-ray production with current transformers, Faraday cups, and hard x-ray collimators, b. They will use paraffin collimators to explore more precisely the energy spectrum of the plasma focus, c. They will pursue the study of the anatomy of the scaling laws. They will operate the two plasma focus machines to study the aforementioned scaling laws. The scaling parameters are the peak voltage and the peak current, d. They will collaborate with two laboratories in Italy (Torino and Frascati) and one in Germany (Darmstadt) in order to cover a wider range of machine power. They will conduct a global survey with the Buenos Aires Plasma Physics Group of the operation of plasma focus machines.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0010, MOLECULAR SPECIES PRESENT IN THE NEUTRAL EFFLUX OF THE SOLID TEFLON PULSED PLASMA THRUSTER

J.K. Hartman, Canisius College, School of Arts & Sciences, Dept. of Physics, *Main & Jefferson Ave., Buffalo, New York* 14208 (DF051960; AFOSR-78-3579)

AF function - space systems, communications satellites. Deficiency - the technology for reliable long-life repeating propulsion systems is not in hand. In part, this is due to lack of sufficient fundamental knowledge about the working fluid of plasma thrusters. Objective - this work will be concerned with performing a variety of mass spectrometer measurements on the plasmas generated in a small solid teflon pulse plasma thruster, in order to improve understanding of the neutral portion of the exhaust beam. How work contributes - it is hoped that the resulting improvement in knowledge will help alleviate users' years of spacecraft contamination and facilitate design of future plasma thrusters and spacecraft.

A borrowed teflon pulse plasma thruster will be made part of a mass spectrometer-vacuum system. The concentration and velocity distributions of neutral species in the thruster exhaust will be measured under various operating conditions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0011, METALS AND ALLOYS

L.D. Roberts, University of North Carolina, Chapel Hill Campus, School of Arts & Sciences, Dept. of Physics, *Chapel Hill, North Carolina* 27514 (DMR7818916)

Metals and alloys will be investigated through the use of a number of closely correlated experimental and theoretical methods. This work will be directed toward gaining more complete information about (a) the metal or alloy wave function in the inner, or core, region of the atoms, (b) the metal or alloy wave function in the immediate vicinity of the atoms, and (c) the forces binding the atoms. It is hoped that a comprehensive theoretical description will be obtained in terms of Relativistic Augmented Plane Wave band structure treatments, and that RAPW pseudopotential calculations can be done which will bear primarily on the alloy studies.

The experimental studies will principally include Mossbauer effect measurements, x-ray chemical shift measurements, and impurity electrical resistance and magnetic studies including Kondo effect measurements. Some of this work will be done at high pressures and at low temperatures.

Studies will be made predominantly for the Mossbauer elements, Au, Sn, Sb, Te, I and Fe, as pure materials or in alloys or compounds with each other or with other elements.

This is the first year of a three-year continuing grant.

Reference: DMR 7517924 A02.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0012, MAGNETIC PHASE TRANSITIONS AND GROUND STATE PROPERTIES OF MAGNETIC CRYSTALS

J.L. Fry, University of Texas, Arlington Campus, Graduate School, Dept. of Physics, *Arlington, Texas* 76019 (DF043370; AFOSR-76-2981)

AF function - this proposed research primarily falls in the 7.4 research objectives which deal with the theoretical and experimental investigations of electronic, optical, acoustic, thermal, magnetic and conducting properties of materials to evolve new and improved device concepts. In particular, the theoretical investigations of the magnetic phase transitions will be done to give a deeper understanding of the physics of magnetic properties in itinerant electron systems. The gaining of this understanding of the precise mechanisms involved lead to meaningful mathematical models which in turn form a more rational and less empirical device design. Deficiency - a wide range of basic research efforts that support the development of devices and device concepts are needed for the application of contemporary electronic electromagnetic technology in the operational Air Force. Most studies of magnetic properties utilize model Hamiltonians, and model potentials which leave a large number of uncertainties. Objective - the major emphasis during the renewal period will be on a thorough study of magnetic phase transition calculations in a number of physically interesting magnetic systems. These calculations make use of the susceptibility studies and at present are based on the temperature Green's function method. Contribution - this research is a part of a comprehensive program in statistical mechanics to study phase transitions.

During the renewal period Oct 1, 1977-Sep 30, 1978 they propose to expand the phase transition calculations from the simplest system and approximations to more complex magnetic systems of interest. By the beginning of the renewal period they expect to have the required computer programs completed and ready for use in more complicated transition metals and transition metal compounds. The major emphais during the renewal period will be on a thorough study of magnetic phase transition calculations in a number of physically interesting magnetic systems. These calculations make use of the susceptibility studies described above and at present are based on the temperature Green's function method which is briefly reviewed here. In the temperature Green's function formalism, which is based on the method of Martin and Schwinger as outlined by Fedders and Martin, the time dependence is contained in an imaginary dimensionless variable which also has a temperature dependence. (Text Abridged)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0013, TRIBOSTIMULATED EXOEMISSION FROM OXIDE COVERED METALS

R.F. Braunlich, Washington State University, School of Arts & Sciences, Dept. of Physics, *Administration Bldg., Room 101, Pullman, Washington* 99163 (DF052890; AFOSR-78-3650)

AF function - future high-performance aircraft will employ an increasing amount of adhesively bonded structures. Deficiency - in order to obtain maximum strength, metal components are anodized to form a thin oxidized layer and the adhesive is then used to bond these layers together. The mechanical strength and other properties of the anodized oxide must be determined in order to insure compatability and strength in the bonded region. Objective - the objective of this research is to examine the fracture dynamics and micromechanics of thin, anodized oxide films on metals by measuring the tribo-emission of charged particles during early stages of microcracking. How work contributes - analysis of the emitted particles will provide greater understanding and optimization of the oxide films grown on metals prior to adhesive bonding.

Tribo-emission of electrons, negative and positive ions and photons will be measured as a function of stress, strain, and fabrication variables. The micro imperfections, chemical and mechanical, will be characterized to develop a better understanding of the mechanism of tribostimulated exoemission. The characteristic exoemission curves (CEC) will be used to develop a testing method for quality control of oxides applied to aircraft sheet metal for the purpose of adhesive bonding.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0014, AEROPHYSICAL ASPECTS OF GAS AND PLASMA FLOWS
I.I. Glass, University of Toronto, *92 College St., Toronto, Ontario, Canada* M5S 1B2 (DF013470; AFOSR-77-3303)

AF function - aerospace vehicles, weaponry. Opportunity - the grantee is performing research in a number of physical gas dynamic problems related to very high-temperature boundary layers, to excitation processes in gas lasers, and to physical explanation of observed sonic boom propagation properties. These problems are basic to gliding reentry aerodynamics, supersonic flight, and laser technology. Objective - the objectives are a) to construct improved computational methods of modeling turbulent mixing in reacting flows, b) to complete a continuing study of ionizing boundary layers and shock waves in the 4-inch x 7-inch shock tube and to examine the implications of the results on the operation of shock tube flow research facilities, c) to continue the study of shock wave reflection modes for real gases by extending it to nitrogen and to argon, d) to follow up on ideas for explaining why sonic boom N-wave shocks have a longer rise time than can be explained in terms of either atmospheric turbulence or by vibrational relaxation. How work contributes - this research will provide a) basic information needed for modeling turbulent mixing in gas lasers and turbine engines, b) a reevaluation of shock wave-boundary layer interactions in shock tube facilities, c) information useful in designing supersonic diffusers for lasers or turbine engine inlets, and d) improved understanding of atmospheric propagation of disturbances from supersonic aircraft.

Graduate and post-doctoral experimental and theoretical research on the above topics will be pursued in the grantee institution.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, ASTRONOMICAL OBSERVATIONS IN THE INFRARED AND ONE MILLIMETER REGIONS WITH EMPHASIS ON SPECTROSCOPY AND INTERFEROMETRY
C.H. Townes, University of California, Berkeley Campus, School of Letters & Science, Dept. of Physics, *Berkeley, California* 94720 (AST7824453)

A variety of instruments and new techniques have been developed at Berkeley over the last several years for improving sensitivity and spectral and angular resolution of certain astronomical observations in a range from the mid-infrared to millimeter wavelengths. Such developmental work is expected to continue. A number of operating instruments resulting from this program are new being used for observations and require additional funding for observing expenses. Further tests and development of new techniques will be carried out in parallel. Wavelength regions in which work can be done include the 5 micron, 10 micron, 20 micron, submillimeter, and millimeter windows of the atmosphere. The instruments now in use include sensitive spectrometers for measuring the abundance and characteristics of ions and molecules in interstellar clouds or stellar atmospheres, and spatial interferometer for measurement of the size of infrared stars. Information which they obtain is important to understanding the physical conditions, origin and dynamics of interstellar clouds, stellar characteristics and formation, the galactic center, and nuclear processes during the life of our Galaxy. Observations will be carried out at several established observatories in the northern hemisphere, and also in Chile for study of the galactic center and objects in the southern skies.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0002, ORIGIN OF COMETS AND THE EVOLUTION OF THEIR ORBITS
E. Everhart, University of Denver, School of Arts & Sciences, Dept. of Physics, *2115 S. University Blvd., Denver, Colorado* 80210 (AST7817513)

Support is to continue a study of the interaction of comets with the solar system using Monte Carlo methods. Besides planetary perturbations, which change the total energies of the comets, the impulses caused by passing stars will also be included for these can make large changes in the perihelia of comets. In comparing the distributions generated by a realistic model with the distributions for real comets, one can get information about dissipation and observational selection effects. Thus, one can find numerical values for the average probability that a comet will be observed on various returns. Another part of the study is to investigate the past and future orbits for a few well-known objects, such as Chiron, a small body with a perihelion at 8.4 times the earth's distance from the sun, recently discovered by Kowal. In particular, calculations will be carried out to find out if Chiron is in a stable libration orbit, or whether it is in an orbit which is chaotic or random in character.

Prior support was by NSF grant AST 76-18891.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0003, ANALYSIS OF NEW HIGH RESOLUTION SOLAR SPECTRA IN THE 2.5 TO 15 MICRON REGION
A. Goldman, University of Denver, School of Arts & Sciences, Dept. of Physics & Astronomy, *2115 S. University Blvd., Denver, Colorado* 80210 (ATM7683908A01)

Ground-based high resolution solar spectra in the 2.5 to 15 micron region will be the basis of a new atlas of atmospheric absorption lines. The atlas will include spectra at 0.06 cm to the minus one power resolution obtained recently from Denver (1.6 km) and the nearby Mount Evans (4.3 km), at both high sun and low sun, and additional spectra to be obtained at these sites. The low sun spectra greatly enhance the sensitivity limits for detection of trace constituents. The spectra will be quantitatively analyzed for the spectral absorption lines and compared with theoretical line parameters.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

10.0004, INTERSTELLAR MOLECULES AND THE EVOLUTION OF STARS
B.M. Zuckerman, University of Maryland, College Park Campus, School of Engineering, Dept. of Physics & Astronomy, *College Park, Maryland* 20742 (AST7617600 A02)

During the years of their birth and death most stars are shrouded in cool envelopes composed of dust and molecules. The chemical evolution of our Milky Way Galaxy is largely due to this interplay between stars and the interstellar medium. The present work will involve a determination of the composition and conditions in the molecular component of the interstellar medium in regions of star formation such as the Orion Nebula. At the same time, there will be a study of the amount and composition of molecular gas ejected back into interstellar space by a typical dying star. Particular emphasis will be placed on determining the amount of carbon in this gas. Carbon in ionic, atomic and molecular form is a very important ingredient in the energy balance in the interstellar medium.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0005, GALACTIC AND EXTRAGALACTIC RADIO ASTRONOMY

B.F. Burke, Massachusetts Inst. of Technology, Graduate School, Dept. of Physics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (AST77-26896)

Studies of galactic structure and the interstellar medium will be carried out in a broadly based program of spectroscopic and continuum radio observations. Very Long Base Line Interferometry (VLBI) observations will concentrate on the study of hydrogen (OH), water (H2O) and silicon oxide (SiO) masers with the aim of determining their structural changes, motions, and detailed structure. The eventual goal is the understanding of the maser mechanisms and the process of star formation. Earlier research on the detailed structure of the nuclei or radio galaxies will be continued. Conventional interferometry will be used to study the structure of galactic supernova remnants and ionized hydrogen (HII) regions using the aperture synthesis interferometer and the Very Large Array (VLA). In addition, a new VLA program will be pursued to study the detailed excitation temperatures of high-velocity clouds. A cooled 7 mm wavelength radiometer now under development will be tested and used for single-dish observations of galactic sources. VLBI methods will be developed for use at millimeter wavelengths. The principal aims of the research will be to understand the physical processes acting in the interstellar medium, interstellar masers, and nonthermal radio sources, and to relate these to processes of galaxy and star formation.

This is a continuation of grant AST 73-05043 A02.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0006, METEORS

A. Cook, Smithsonian Institution, Astrophysical Observatory, *60 Garden St., Cambridge, Massachusetts* 02138 (31P-4P50-01)

Planetary Studies: Dr. Cook's research has yielded three completed studies which are being prepared for publication. The first of these is an interpretation of the failure to observe Saturn's rings in radio emission at wavelengths longer than 2 mm although they are seen in absorption against the disk out to 3.7 cm and in back-scattered radar reflection at 12.6 cm. The second is a study of the predicted toroid of atomic hydrogen around Titan's orbit. The third is a study of the kinetics of collisions among particles in the rings. For the rings, snowballs of methane clathrate hydrate, ammonium hydrate and water ice with radii about 5 cm are required to explain the observations. For Titan's toroid, there is little likelihood that much atomic hydrogen is there. Study of the kinetics of the rings indicates that the frequency of collisions must be very low (of the order of the libration periods for resonances with Mimas, or one per decade) and that the thickness of the rings is comparable to or less than the interparticle distance. Dr. Cook and Dr. Franklin are preparing a paper concerning the absence of a ring about Uranus.

Meteors: Dr. Cook completed his editorial duties on the volume for IAU Colloquium No. 13 with Prof. Hemenway (Dudley Observatory) & Dr. Millman (National Research Council) which has appeared. Dr. Cook and Dr. Millman have commenced a spectrophotometric analysis of the National Research Council of Canada's brightest observed Perseid. Dr. Cook, Prof. Hemenway & Dr. Millman have been preparing for a new observing program using new televison equipment for study of spectra of faint meteors to be carried out jointly with the Dudley Observatory and the National Research Council of Canada.

SUPPORTED BY Smithsonian Institution, Astrophysical Observatory

10.0007, MEASUREMENT OF TRITIUM AND ARGON IN RETURNED LUNAR MATERIALS (ISOTOPIC STUDIES)

E.L. Fireman, Smithsonian Institution, Astrophysical Observatory, *60 Garden St., Cambridge, Massachusetts* 02138 (NGR 09-015-145)

OBJECTIVES: 1) Measure Ar37, Ar39, and H3 as a function of depth in the deep core of a large documented rock from Apollo 17. 2) Continue to measure the Ar39 and H3 in two large documented rocks of different chemical compositions from either Apollo 17 or previous Apollo missions. 3) Also measure Ar39 production cross sections in thick Ti, Ca, and K targets bombarded with protons of energies between 50 and 600 Mev. 4) Measure H3 in four quadrants of oriented aluminum tube G3 from Surveyor 3. Determine ages and histories of meteorites by means of isotope measurements.

SUPPORTED BY Smithsonian Institution, Astrophysical Observatory

10.0008, OPTICAL AND ULTRAVIOLET SPECTROSCOPY OF PLANETARY NEBULAE

J.H. Lutz, Washington State University, School of Arts & Sciences, Dept. of Pure & Applied Mathematics, *Administration Bldg., Room 101, Pullman, Washington* 99163 (AST7821025)

This project will involve research on the spectra of the central stars of planetary nebulae. There will be an analysis of the intensity of radiation in the emission and absorption lines in the spectra of these stars. The distances to these objects will be determined, and these data will be used to model each peculiar central star in terms of either a system composed of two stars or as a single star with a shell.

There will also be an analysis of the ultraviolet radiation from planetary nebulae shells and central stars. The intensities of the ultraviolet emission lines from the nebular shells will be used to find electron densities and temperatures and to model the structure of ionization within the planetary nebulae. The analysis of the ultraviolet radiation from the central star will provide information on the physical conditions in the stellar atmosphere of these stars. These studies of the central stars and of the spectra will contribute to the understanding of planetary nebulae and their role in stellar evolution.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

GENERAL

11.0001, HISTORY OF FLIGHT STRUCTURES

H.S. Wolko, Smithsonian Institution, Dept. of Science & Technology, *1000 Jefferson Dr. S.W., Washington, District of Columbia* 20560

Although the history of flight has been treated at some length by aerospace historians there is a notable void in the literature regarding the particular areas of specialization within flight technology. Most noticeable is the complete absence of historical material on flight structures.

This investigation is intended to be an historical survey covering the evolution of flight structures and their progressive refinement. Particular attention will be paid to the introduction of stressed skin construction and the evolution of the metal airframe.

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Scientific and Technical Aerospace Reports

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01 AERONAUTICS (GENERAL)

N79-31136*# National Aeronautics and Space Administration, Washington, D. C.
A COMPARISON OF PREDICTIONS OBTAINED FROM WIND TUNNEL TESTS AND THE RESULTS FROM CRUISING FLIGHT: AIRBUS AND CONCORDE
J. Berger Aug. 1979 71 p refs Transl. into ENGLISH of "Comparison entre les resultats de vol en croisiere: Airbus et Concorde", AGARD-CP-242, Rept-20 Presented at Flight Mechanics Panel Specialists Meeting on Performance Prediction Methods, Paris, France, 11-13 Oct. 1977 Original language document was announced as N78-26074 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Aerospatiale (France)
(Contract NASw-3199)
(NASA-TM-75238; AGARD-CP-242; Rept-20) Avail: NTIS HC A04/MF A01 CSCL 02A

Following a summary of the methods used to establish aerodynamic data and propulsion data, a comparison was made in the form of the drag (or thrust) difference between flight results and predictions made on the basis of these data. Certain hypothesis and improvements on aerodynamic data were presented in order to explain the slight deficit found on Airbus and Concorde. M.M.M.

N79-31137*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE PROMISE OF MULTICYCLIC CONTROL
John L. McCloud, III Aug. 1979 36 p refs
(NASA-TM-78621; A-7955) Avail: NTIS HC A03/MF A01 CSCL 02A

Several types of rotors which employ multicyclic control are reviewed and compared. Their differences are high-lighted and their potential advantages and disadvantages are discussed. The flow field these rotors must operate in is discussed, and it is shown that simultaneous elimination of vibration and oscillatory blade loads is not an inherent solution to the roughness problem. The use of rotor blades as energy absorbers is proposed. Input-output relations are considered and a gain control for ROMULAN, a multicyclic controlling computer program, is introduced. Implications of the introduction of multicyclic systems into helicopters are discussed. A.W.H.

N79-31138# Textron Bell Aerospace Co., New Orleans, La.
MARITIME PATROL AIRSHIP CONCEPT STUDY Final Report, 18 Apr. - 31 Oct. 1978
James C. Bell, James D. Marketos, and A. D. Topping 16 Nov. 1978 242 p refs
(Contract N62269-78-M-6956)
(AD-A070131; NADC-78074-60; Rept-7575-927030) Avail: NTIS HC A11/MF A01 CSCL 01/3

Results of a preliminary conceptual parametric design study for a maritime patrol airship to be used by the U. S. Coast Guard or Navy are presented. Eight different Coast Guard mission profiles are considered, and an optimum airship point design is developed for each. The report discusses mission requirements, airship operational requirements, the conceptual design approach, and the parametric design study which uses a computer program to assist in optimizing the critical parameters for each airship mission design. The study includes airship sizes from 220,000 cu ft 18,000 lb vertical takeoff weight to 3,000,000 cu ft 230,000 lb vertical takeoff weight. Results show the unique features of the Bell unballasted, reversible thrust airship design and the critical need for design optimiztion, owing to the sensitivity of the airship design parameters. The computer design program shows airship conceptual differences and design trends rather than absolute design configurations, since it uses the preliminary subsystem weight relationships developed for recent airship parametric studies. Although the study design trends should remain valid, additional studies are recommended to establish better subsystem weight estimates and to incorporate life-cycle costing. GRA

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N79-31139*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
SKIN FRICTION MEASURING DEVICE FOR AIRCRAFT Patent Application
Lawrence C. Montoya and Donald R. Bellman, inventors (to NASA) Filed 7 Aug. 1979 17 p
(NASA-Case-FRC-11029-1; US-Patent-Appl-SN-064617) Avail: NTIS HC A02/MF A01 CSCL 01A

A skin friction measuring device for measuring the resistance of an aerodynamic surface to an airstream is disclosed. It is characterized by a friction plate adapted to be disposed in a flush relationship with the external surface of the aircraft and be displaced in response to skin friction drag as an airstream is caused to flow over the surface. A potentiometer is connected to the plate in order to provide an electrical output indicative of the magnitude of the drag. NASA

N79-31140# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
OSCILLATIONS OF THE SUPERSONIC FLOW DOWNSTREAM OF AN ABRUPT INCREASE IN DUCT CROSS-SECTION
G. E. A. Meier, G. Grabitz, W. M. Jungowski (Warsaw Technical Univ.), K. J. Witczak (Warsaw Technical Univ.), and J. S. Anderson (The City Univ., London) 1978 173 p refs Backup document for AIAA Synoptic, scheduled for publication in AIAA Journal in March 1980
(Rept-65; Log-J11289) Avail: NTIS HC A08/MF A01

A description of the phenomenological aspects, the mecha-

nism and the theoretical treatment, especially of the so called base pressure oscillation, is given. The base pressure oscillation occurs in the flow region immediately downstream of the sudden enlargement of cross-section, in the case for which a supersonic expanding flow with a Mach-disk just fills the enlarged cross-section. Other types of oscillation are observed in a position further downstream, if the steady pattern of wall-reflected shocks, initiated in the area of enlargement, interacts with the shocks at the end of the supersonic core flow. M.M.M.

N79-31141*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
POWERED LOW-ASPECT-RATIO WING IN GROUND EFFECT (WIG) AERODYNAMIC CHARACTERISTICS
James L. Thomas, John W. Paulson, Jr., and Richard J. Margason Jul. 1979 49 p refs
(NASA-TM-78793) Avail: NTIS HC A03/MF A01 CSCL 01A

A wing-in-ground effect configuration was investigated. The configuration used large diameter, low pressure ratio fans mounted about 0.76 wing chord ahead of the wing leading edge to achieve a power augmented ram wing during operation in ground effect. Tests of both in and out of ground effect aerodynamic transition characteristics from very low speeds to cruise speeds are described. The investigation provided a number of conclusions concerning the aerodynamic/propulsive performance interaction. While power augmented lift is required for low speed flight, there is a thrust loss when the efflux is trapped under the wing which reduced the effective thrust to weight available for acceleration by about a third of the installed thrust to weight ratio. A.W.H.

N79-31142*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
COMPARISON OF THREE-DIMENSIONAL PANEL METHODS WITH STRIP BOUNDARY-LAYER SIMULATIONS TO EXPERIMENT
Scott O. Kjelgaard and James L. Thomas Jul. 1979 51 p refs
(NASA-TM-80088) Avail: NTIS HC A04/MF A01 CSCL 01A

Several three dimensional surface panel methods coupled on a streamwise strip basis to two dimensional boundary layer methods were compared to experimental data. Several different boundary layer simulations were investigated. Comparable boundary layer effects which converge to the expected two dimensional result wind increasing aspect ratio were indicated by either a transpiration or camber line displacement simulation. The method was applied to several varied configurations. The lift predictions agreed well with an approximate method based on correcting the inviscid lift using the two dimensional section viscous characteristics. The wing pressures and the effect of the boundary layer on the wing pressures were predicted accurately. A.W.H.

N79-31143*# Old Dominion Univ., Norfolk, Va.
SUBSONIC WIND-TUNNEL INVESTIGATION OF LEADING-EDGE DEVICES ON DELTA WINGS (DATA REPORT)
M. Rao Dhanvada and Thomas D. Johnson, Jr. Aug. 1979 131 p refs
(Grant NGR-47-003-052)
(NASA-CR-159120) Avail: NTIS HC A07/MF A01 CSCL 01A

The drag reduction potential of leading edge devices on delta wings at high lift is presented. Fences, pylon type vortex generators, chordwise slots, and sharp plate extensions were tested on wing models with 60 and 74 degree swept blunt leading edges at angles of attack to 32 degrees. Six component balance and leading edge surface pressure measurements were taken with various geometry and spanwise arrangements of the devices. Tables listing the data, without analysis, are presented. A.W.H.

N79-31144*# Boeing Commercial Airplane Co., Seattle, Wash.
DYNAMIC LOADS ANALYSIS SYSTEM (DYLOFLEX) SUMMARY. VOLUME 1: ENGINEERING FORMULATION
R. D. Miller, R. I. Kroll, and R. E. Clemmons Sep. 1979 88 p refs 2 Vol.
(Contract NAS1-13918)
(NASA-CR-2846-1; D6-44455-Vol-1) Avail: NTIS HC A05/MF A01 CSCL 01A

The DYLOFLEX computer program system expands the aeroelastic cycle from that in the FLEXSTAB computer program system to include dynamic loads analyses involving active controls. Two aerodynamic options exist within DYLOFLEX. The analyst can formulate the problem with unsteady aerodynamics calculated using the doublet lattice method or with quasi-steady aerodynamics formulated from either FLEXSTAB or doublet lattice steady state aerodynamics with unsteady effects approximated by indicial lift growth functions. The equations of motion are formulated assuming straight and level flight and small motions. Loads are calculated using the force summation technique. DYLOFLEX consists of nine standalone programs which can be linked with each other by magnetic files used to transmit the required data between programs. Author

N79-31145*# Boeing Commercial Airplane Co., Seattle, Wash.
DYNAMIC LOADS ANALYSIS SYSTEM (DYLOFLEX) SUMMARY. VOLUME 2: SUPPLEMENTAL SYSTEM DESIGN INFORMATION
R. D. Miller, R. I. Kroll, and R. E. Clemmons Sep. 1979 60 p refs 2 Vol.
(Contract NAS1-13918)
(NASA-CR-2846-2; D6-44455-Vol-2) Avail: NTIS HC A04/MF A01 CSCL 01A

Contents: execution of the DYLOFLEX program system; magnetic file format; DYLIB - the DYLOFLEX alternate subroutine library; and prefaces for DYLIB subroutines. A.R.H.

N79-31146# Aeronautical Research Labs., Melbourne (Australia).
LATERAL AERODYNAMICS EXTRACTED FROM FLIGHT TEST USING A PARAMETER ESTIMATION METHOD
R. A. Feik Oct. 1978 45 p refs
(ARL-AERO-NOTE-380; AR-001-311) Avail: NTIS HC A03/MF A01

Flight data from a 60 deg delta wing aircraft was analyzed using a modified Newton-Raphson parameter estimation procedure. The model equations used for the analysis were extended to account for sideslip vane errors and for lateral accelerometer position error. Lateral derivatives extracted from the data were compared with wind tunnel measurements and theoretical estimates and areas of agreement and disagreement identified. The method was also applied to the analysis of fin loads measured in flight and some tentative conclusions reached. The results confirm the effectiveness of the parameter identification procedure in flight test analysis and its ready applicability to a variety of related problems. M.M.M.

N79-31147*# Boeing Commercial Airplane Co., Seattle, Wash.
MODAL INTERPOLATION PROGRAM, L215(INTERP). VOLUME 2: SUPPLEMENTAL SYSTEM DESIGN AND MAINTENANCE DOCUMENT
M. Y. Hirayama and R. I. Kroll Washington NASA Sep. 1979 69 p refs
(Contract NAS1-13918)
(NASA-CR-2848; D6-44457) Avail: NTIS HC A04/MF A01 CSCL 01A

The design, structure, and usage of the modal interpolation program L215 are presented. The program uses modal data sets of arrays containing interpolation coefficients. The interpolation arrays are used to determine displacements at various aerodynamic control points. The displacements consist of translations normal to the aerodynamic surface and surface slopes that are parallel and perpendicular to the free stream direction. Five different interpolation methods are available. A.W.H.

N79-31148*# Boeing Commercial Airplane Co., Seattle, Wash.
A PROGRAM TO COMPUTE THREE-DIMENSIONAL SUBSONIC UNSTEADY AERODYNAMIC CHARACTERISTICS USING THE DOUBLET LATTICE METHOD, L216 (DUBFLEX). VOLUME 2: SUPPLEMENTAL SYSTEM DESIGN AND MAINTENANCE DOCUMENT Topical Report, May 1975 - May 1977
B. A. Harrison and M. Richard Washington NASA Sep. 1979 75 p refs 2 Vol.

(Contract NAS1-13918)
(NASA-CR-2850; D6-44459) Avail: NTIS HC A04/MF A01 CSCL 01A

The information necessary for execution of the digital computer program L216 on the CDC 6600 is described. L216 characteristics are based on the doublet lattice method. Arbitrary aerodynamic configurations may be represented with combinations of nonplanar lifting surfaces composed of finite constant pressure panel elements, and axially summetric slender bodies composed of constant pressure line elements. Program input consists of configuration geometry, aerodynamic parameters, and modal data; output includes element geometry, pressure difference distributions, integrated aerodynamic coefficients, stability derivatives, generalized aerodynamic forces, and aerodynamic influence coefficient matrices. Optionally, modal data may be input on magnetic field (tape or disk), and certain geometric and aerodynamic output may be saved for subsequent use. A.R.H.

N79-31149*# Bihrle Applied Research, Inc., Jericho, N. Y.
ROTARY BALANCE DATA FOR A TYPICAL SINGLE-ENGINE GENERAL AVIATION DESIGN FOR AN ANGLE-OF-ATTACK RANGE OF 8 DEG TO 90 DEG. 2: HIGH-WING MODEL A
William Mulcay and Robert Rose Washington NASA Sep. 1979 116 p refs
(Contract NAS1-14849)
(NASA-CR-3101) Avail: NTIS HC A06/MF A01 CSCL 01A

Aerodynamic characteristics obtained in a rotational flow environment utilizing a rotary balance located in the Langley spin tunnel are presented in plotted form for a 1/5-scale, single-engine, high-wing, general aviation airplane model. The configurations tested included various tail designs and fuselage shapes. Data are presented without analysis for an angle of attack range of 8 to 90 degrees and clockwise and counter-clockwise rotations covering an Omega b/2 v range from 0 to 0.85. M.M.M.

N79-31150*# Lockheed Missiles and Space Co., Palo Alto, Calif.
NUMERICAL METHOD FOR PREDICTING FLOW CHARACTERISTICS AND PERFORMANCE OF NONAXISYMMETRIC NOZZLES, THEORY
P. D. Thomas Washington NASA Sep. 1979 109 p refs
(Contract NAS1-15084)
(NASA-CR-3147; LMSC-D633457) Avail: NTIS HC A06/MF A01 CSCL 01A

The theoretical foundation and formulation of a numerical method for predicting the viscous flowfield in and about isolated three dimensional nozzles of geometrically complex configuration are presented. High Reynolds number turbulent flows are of primary interest for any combination of subsonic, transonic, and supersonic flow conditions inside or outside the nozzle. An alternating-direction implicit (ADI) numerical technique is employed to integrate the unsteady Navier-Stokes equations until an asymptotic steady-state solution is reached. Boundary conditions are computed with an implicit technique compatible with the ADI technique employed at interior points of the flow region. The equations are formulated and solved in a boundary-conforming curvilinear coordinate system. The curvilinear coordinate system and computational grid is generated numerically as the solution to an elliptic boundary value problem. A method is developed that automatically adjusts the elliptic system so that the interior grid spacing is controlled directly by the a priori selection of the grid spacing on the boundaries of the flow region. M.M.M.

N79-31151*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
WIND-TUNNEL INVESTIGATION OF AN ARMED MINI REMOTELY PILOTED VEHICLE
Arthur E. Phelps, III Sep. 1979 62 p refs Prepared in cooperation with Army Aviation Research and Development Command, St. Louis, Mo.
(DA Proj. 1L1-61102-AH-45)
(NASA-TM-80132; L-13026; AVRADCOM-TR-79-41) Avail: NTIS HC A04/MF A01 CSCL 01A

A wind tunnel investigation of a full scale remotely piloted vehicle (RPV) armed with rocket launchers was conducted. The model had unacceptable longitudinal stability characteristics at negative angles of attack in the original design configuration. The addition of a pair of fins mounted in a V arrangement on the propeller shroud resulted in a configuration with acceptable longitudinal stability characteristics. The addition of wing mounted external stores to the modified configuration resulted in a slight reduction in the longitudinal stability. The lateral directional characteristics of the model were generally good, but the model had low directional stability at low angles of attack. Aerodynamic control power was very strong around all three axes. A.W.H.

N79-31152*# Bihrle Applied Research, Inc., Jericho, N. Y.
ROTARY BALANCE DATA FOR A SINGLE-ENGINE TRAINER DESIGN FOR AN ANGLE-OF-ATTACK RANGE OF 8 DEG TO 90 DEG
Paul Pantason and Waldo Dickens Washington NASA Aug. 1979 327 p
(Contract NAS1-14849)
(NASA-CR-3099) Avail: NTIS HC A15/MF A01 CSCL 01A

Aerodynamic characteristics obtained in a rotational flow environment utilizing a rotary balance located in the Langley spin tunnel are presented in plotted form for a 1/6 scale, single engine trainer airplane model. The configurations tested included the basic airplane, various wing leading edge devices, elevator, aileron and rudder control settings as well as airplane components. Data are presented without analysis for an angle of attack range of 8 to 90 degrees and clockwise and counter-clockwise rotations. Author

N79-31153*# Boeing Commercial Airplane Co., Seattle, Wash.
EQUATION MODIFYING PROGRAM, L219 (EQMOD). VOLUME 2: SUPPLEMENTAL SYSTEM DESIGN AND MAINTENANCE DOCUMENT Topical Report, May 1975 - May 1977
M. Y. Hirayama, R. E. Clemmons, and R. D. Miller Washington NASA Sep. 1979 65 p refs
(Contract NAS1-13918)
(NASA-CR-2856; D6-44465-Vol-2) Avail: NTIS HC A04/MF A01 CSCL 01A

A digital computer program, L219 (EQMOD), available for execution on the CDC 6600 is described. The program modifies matrices according to card input instructions and prepares magnetic files of matrices suitable for use in the linear systems analysis program (QR) and the random harmonic analysis program L221 (TEV156). The particular field of application of the program is the modification of the theoretical equations of motion and load equations generated in DYLOFLEX by the equation of motion program (L217) and the load equation program (L218), respectively. J.M.S.

N79-31154*# Boeing Commercial Airplane Co., Seattle, Wash.
TIME HISTORY SOLUTION PROGRAM, L225 (TEV126). VOLUME 2: SUPPLEMENTAL SYSTEM DESIGN AND MAINTENANCE DOCUMENT Topical Report, May 1975 - May 1977
A. Tornallyay, R. E. Clemmons, and R. I. Kroll Washington NASA Sep. 1979 34 p refs
(Contract NAS1-13918)
(NASA-CR-2860; D6-44469-Vol-2) Avail: NTIS HC A03/MF A01 CSCL 01A

The time history solution program L225 (TEV126) is described. The program calculates the time responses of a linear system by convoluting the impulsive response functions with the time dependent excitation. The convolution is performed as a multiplication in the frequency domain. Fast Fourier transform techniques are used to transform the product back into the time domain to obtain response time histories. The design and structure of the program is presented. A.W.H.

N79-31155*# Boeing Commercial Airplane Co., Seattle, Wash.
A PROGRAM FOR CALCULATING LOAD COEFFICIENT MATRICES UTILIZING THE FORCE SUMMATION METHOD, L218 (LOADS). VOLUME 2: SUPPLEMENTAL SYSTEM DESIGN AND MAINTENANCE DOCUMENT Topical Report, May 1975 - May 1977
L. R. Anderson and R. D. Miller Washington NASA Sep. 1979 94 p refs

(Contract NAS1-13918)
(NASA-CR-2854; D6-44463-Vol-2) Avail: NTIS HC A05/MF A01 CSCL 01A

The LOADS computer program L218 which calculates dynamic load coefficient matrices utilizing the force summation method is described. The load equations are derived for a flight vehicle in straight and level flight and excited by gusts and/or control motions. In addition, sensor equations are calculated for use with an active control system. The load coefficient matrices are calculated for the following types of loads: (1) translational and rotational accelerations, velocities, and displacements; (2) panel aerodynamic forces; (3) net panel forces; and (4) shears, bending moments, and torsions. J.M.S.

N79-31156# ARO, Inc., Arnold Air Force Station, Tenn.
A FORCE AND MOMENT TEST OF A 1/24-SCALE F-111 MODEL AT MACH NUMBERS FROM 0.7 TO 1.3 Final Report
C. G. Burchfield AEDC 2 Mar. 1979 17 p refs
(AD-A070192; AEDC-TSR-79-P14) Avail: NTIS HC A02/MF A01 CSCL 01/3

A test program was conducted in the Propulsion Wind Tunnel 16 T to determine forces and moments on a 1/24-scale F-111 model. Data were obtained at Mach numbers from 0.7 to 1.3 at total pressures of 1200 and 2000 psfa. Model angle of attack was varied from 2 to 20 deg at 0 deg sideslip. Sideslip angles were varied from -10 to 10 deg at 10 and 15 deg angles of attack. GRA

N79-31157# Purdue Univ., Lafayette, Ind. School of Aeronautics and Astronautics.
FLUTTER ANALYSIS OF TWO-DIMENSIONAL AND TWO-DEGREE-OF-FREEDOM AIRFOILS IN SMALL-DISTURBANCE, UNSTEADY TRANSONIC FLOW Final Report, Nov. 1977 - Oct. 1978
T. Y. Yang, Alfred G. Striz, and P. Guruswamy Dec. 1978 116 p refs
(Grant AF-AFOSR-3523-78; AF Proj. 2307)
(AD-A069223; AFFDL-TR-78-202) Avail: NTIS HC A06/MF A01 CSCL 20/4

Flutter analyses are performed for a NACA 64A006 and a NACA 64A010 airfoil by simultaneously using two transonic aerodynamic computational codes: (1) STRANS2 and UTRANS2 based on the relaxation method and (2) LTRAN2 based on the indicial and time-integration methods. Flutter results are obtained as plots of flutter speeds and the corresponding reduced frequencies versus one of the four parameters; airfoil-air mass ratio; position of the mass center; position of the elastic axis; and free stream Mach number. On each figure, several sets of curves for different values of plunge-to-pitch frequency ratios are shown simultaneously. The flutter results obtained by using relaxation and the indicial methods are, in general, in good agreement. The present flutter results for a special case of a thin parabolic airfoil at a low transonic Mach number of 0.7 compare favorably with that obtained by using linear flat plate theory. The trend of each flutter curve and the effect of each parameter are discussed in detail. GRA

N79-31158# Louisiana State Univ. and A&M Coll., Baton Rouge. Dept. of Mechanical Engineering.
AERODYNAMIC HEATING OF CONVENTIONAL WEAPONS Final Report, 5 Jan. 1977 - 4 Mar. 1979
Dupree Maples 1979 64 p
(Grant AF-AFOSR-3250-77)
(AD-A069807; AFOSR-79-0659TR) Avail: NTIS HC A04/MF A01 CSCL 20/4

A two-pronged effort in aerodynamic heating was performed. The first, and more basic requirement, was an experimental analysis of heating incurred by conventional weapons. The second effort, which was related to the first, concerned investigating heat transfer mechanisms found in and around weapons. Some of the isolated areas to be investigated were: thermal contact conductance, convective heat transfer coefficient review and analysis, thermal control methods as applied to weapons, and thermal scale modeling involving convection/conduction. The first requirement of this research program was to establish a thermal laboratory at the AFATL. This laboratory was designed to have the capabilities to experimentally investigate the effects of heating on full-scale weapons. The design included a radiant energy thermal excitation system to simulate surface heat fluxes and temperatures encountered during aerodynamic heating missions. The second requirement was accomplished by an investigation of the contact conductance of screw threads. This was selected since the fuses are normally connected to the main weapon by threads. GRA

N79-31159# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
EXPERIMENTAL DATA BASE FOR COMPUTER PROGRAM ASSESSMENT: REPORT OF THE FLUID DYNAMICS PANEL WORKING GROUP 04
May 1979 609 p refs
(AGARD-AR-138; ISBN-92-835-1323-1) Avail: NTIS HC A99/MF A01

The acquisition of highly reliable wind tunnel test data for aircraft design was investigated. For individual titles, see N79-31160 through N79-31162.

N79-31160# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany).
INTRODUCTION AND OVERVIEW OF CONFIGURATIONS
Juergen Barche *In* AGARD Exptl. Data Base for Computer Program Assessment May 1979 5 p (For primary document see N79-31159 22-02)
Avail: NTIS HC A99/MF A01

An overview of the application of two- and three-dimensional transonic flows to aircraft design is presented. The criteria for two-dimensional, three-dimensional, and body-alone configurations are tabulated. F.O.S.

N79-31161# ARO, Inc., Arnold Air Force Station, Tenn.
LIMITATIONS OF AVAILABLE DATA
Travis W. Binion *In* AGARD Exptl. Data Base for Computer Program Assessment May 1979 8 p refs (For primary document see N79-31159 22-02)
Avail: NTIS HC A99/MF A01

The factors affecting wind tunnel test results are discussed. These include: flow nonuniformity, three-dimensional effects in two-dimensional tests, support interference, aeroelastic effects, flow unsteadiness, wall interference, wave reflections, and boundary conditions. F.O.S.

N79-31162# Royal Aircraft Establishment, Bedford (England).
RECOMMENDATIONS FOR FUTURE TESTING
K. G. Winter and L. H. Ohman (NAE, Ottawa, Ont.) *In* AGARD Exptl. Data Base for Computer Program Assessment May 1979 3 p refs (For primary document see N79-31159 22-02)
Avail: NTIS HC A99/MF A01

Recommendations for improvements in tunnel techniques to achieve highly reliable data for aircraft design are presented. Interferences and disturbances for two- and three-dimensional flows are discussed. F.O.S.

N79-31687# Consiglio Nazionale delle Ricerche, Rome (Italy). Servizio Attivita Spaziali.
TRANSATLANTIC FLIGHTS OF STRATOSPHERIC BALLOONS [LES VOLS TRANSATLANTIQUES DES BALLONS STRATOSPHERIQUES]
G. P. Cecchini and M. Malavasi *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 377-381 In FRENCH; ENGLISH summary (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

N79-31688# Centre National d'Etudes Spatiales, Toulouse (France).
FIRST EXPERIMENTAL TRANSMEDITERRANEAN BALLOON FLIGHT
M. Malavasi (Consiglio Nazl. delle Ric.), J. Medina (Grupos Cien. de la CONIE), J. Sequeiros (Grupos Cien. de la CONIE), and A. Soubrier *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 383-386 (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

N79-31689# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
CONCEPT AND FIRST EXPERIENCES WITH THE DFVLR MOBILE BALLOON BASE
G. Reimann and H. D. Schlichter *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 387-391 (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

N79-31691# Centre National d'Etudes Spatiales, Toulouse (France).
PREVISIONS AND EXPERIMENTAL RESULTS IN OPEN BALLOON CONTROLLED DESCENT [PREVISION ET DEPOUILLEMENTS DE VOLS DE BALLONS OUVERTS EN DESCENTE PILOTE]
M. Romero, M. Rougeron, and C. Tockert *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 397-402 refs In FRENCH (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

N79-31163*# National Aeronautics and Space Administration, Washington, D. C.
SUPERSONIC TRANSPORT VIS-A-VIS ENERGY SAVINGS
G. Cormery Sep. 1979 27 p Transl. into ENGLISH from Aeron. Astronaut (Paris), vol. 69, no. 2, 1978 p 3-14 Original language document was announced as A78-35893 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75464) Avail: NTIS HC A03/MF A01 CSCL 01C

The energy and economic saving modifications in supersonic transportation are studied. Modifications in the propulsion systems and in the aerodynamic configurations of the Concorde aircraft to reduce noise generation and increase fuel efficiency are discussed. The conversion of supersonic aircraft from fuel oils to synthetic fuels is examined. A.W.H.

N79-31164*# Boeing Vertol Co., Philadelphia, Pa.
DEVELOPMENT OF CRASHWORTHY PASSENGER SEATS FOR GENERAL-AVIATION AIRCRAFT
M. J. Reilly and A. E. Tanner Aug. 1979 112 p refs
(Contract NAS1-14637)
(NASA-CR-159100; D210-11336-1) Avail: NTIS HC A06/MF A01 CSCL 01C

Two types of energy absorbing passenger seat concepts suitable for installation in light twin-engine fixed wing aircraft were developed. An existing passenger seat for such an aircraft was used to obtain the envelope constraints. Ceiling suspended and floor supported seat concept designs were developed. A restraint system suitable for both concepts was designed. Energy absorbing hardware for both concepts was fabricated and tension and compression tests were conducted to demonstrate the stroking capability and the force deflection characteristics. Crash impact analysis was made and seat loads developed. The basic seat structures were analyzed to determine the adequacy of their strength under impact loading. R.E.S.

N79-31165# National Transportation Safety Board, Washington, D. C.
AIRCRAFT ACCIDENT REPORT: SWIFT AIRE LINES, INC., NORD 262, N418SA, MARINA DEL REY, CALIFORNIA, MARCH 10, 1979
16 Aug. 1979 32 p
(NTSB-AAR-79-13) Avail: NTIS HC A03/MF A01

On March 10, 1979, Flight 235, A-Nord 262, ditched in the Santa Monica Bay near Marina Del Rey, California, shortly after takeoff from Los Angeles International Airport. Flight 235 was a scheduled commuter airline passenger flight from Los Angeles, California, to Santa Maria, California, with four passengers and three crewmembers on board. The probable cause of the accident was determined to be the flightcrew's mismanagement of an emergency procedure following an autofeather of the right propeller which resulted in their shutting down the remaining engine. Contributing to the accident was the unavailability of vital restart information to the crew. A.W.H.

N79-31166*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
CONFERENCE ON FIRE RESISTANT MATERIALS: A COMPILATION OF PRESENTATIONS AND PAPERS
Demetrius A. Kourtides, ed. and Gerald A. Johnson, ed. (Boeing Com. Airplane Co., Seattle, Wash.) Jul. 1979 287 p Conf. held in Seattle, 1-2 Mar. 1979
(NASA-CP-2094; A-7894) Avail: NTIS HC A13/MF A01 CSCL 01C

The proceedings of the NASA IRE Resistant Materials Engineering (FIREMEN) Program held at Boeing Commercial Airplane Company, Seattle, Washington, on March 1-2, 1979 are reported. The conference was to discuss the results of research by the National Aeronautics and Space Administration in the field of aircraft fire safety and fire-resistant materials. The program topics include the following: (1) large-scale testing; (2) fire toxicology; (3) polymeric materials; and (4) fire modeling. For individual titles, see N79-31167 through N79-31183.

N79-31167*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
AIRPORT FLAMMABILITY, FULL SCALE FIRE TESTS
Richard W. Bricker *In* NASA. Ames Res. Center Conf. on Fire Resistant Mater. Jul. 1979 p 1-12 (For primary document see N79-31166 22-03)
Avail: NTIS HC A13/MF A01 CSCL 01C

The primary objectives of the fire tests are: (1) conduct full scale test with 737 fuselages by the end of 1980; (2) demonstrate evacuation time increase to five minutes minimum; (3) show that exterior fire will not penetrate an intact cabin for five minutes; (4) show that closed cabin will not have excess smoke or temperatures above 400 F; and (5) demonstrate that fire in cabin opening will not propagate throughout cabin. The test program has three phases. A test schedule and status of required materials are presented. G.Y.

N79-31168*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SEAT TEST PROGRAM
Richard W. Bricker *In* NASA. Ames Res. Center Conf. on Fire Resistant Mater. Jul. 1979 p 13-26 (For primary document see N79-31166 22-03)
Avail: NTIS HC A13/MF A01 CSCL 01C

The test program has the objectives to: (1) evaluate severity of newspaper ignition source with contemporary seats (determine weight loss, visual damage, and if ignition source is severe enough to show improvement with new material configurations); (2) compare damage with jet A-1 ignition source; and (3) determine if materials for seat tests pass FAR 25 and obtain L01. Test configurations, data acquired, material test results, seat test results, and conclusions are presented. G.Y.

N79-31169*# Southwest Foundation for Research and Education, San Antonio, Tex.
RECENT ADVANCES IN MATERIALS TOXICOLOGY
Dane M. Russo *In* NASA. Ames Res. Center Conf. on Fire Resistant Mater. Jul. 1979 p 27-43 (For primary document see N79-31166 22-03)
Avail: NTIS HC A13/MF A01 CSCL 01C

An overview of the fire toxicology program, its principal objectives and approach, is outlined. The laboratory methods of assessing pyrolysis product toxicity for two experiments are presented. The two experiments are: a comparison of test end points; and an evaluation of operant techniques. A third experiment is outlined for a comparison of full-scale and laboratory toxicity tests, with the purpose of determining animal survivability in full-scale tests. Future research plans are also outlined. G.Y.

N79-31170*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
STATUS OF CANDIDATE MATERIALS FOR FULL-SCALE TESTS IN THE 737 FUSELAGE
Daniel Supkis *In* NASA. Ames Res. Center Conf. on Fire Resistant Mater. Jul. 1979 p 45-69 (For primary document see N79-31166 22-03)
Avail: NTIS HC A13/MF A01 CSCL 01C

The test program has the objectives to: (1) increase passenger evacuation time to a minimum of five minutes from commercial aircraft in case of a fire; (2) prevent an external fire from entering closed cabins for five minutes by using fire barrier materials in the exterior wall; (3) demonstrate that a closed cabin will not reach 400 F; and (4) prove that a fire near a cabin opening will not propagate through the cabin for a minimum of five minutes. The materials status is outlined for seat cushions, upholstery and associated seat materials, wall and ceiling panels, floor panels, carpet and carpet underlay, windows, cargo bay liners, insulation bagging, and thermal acoustical insulation. G.Y.

N79-31171*# Solar Turbines International, San Diego, Calif.
DEVELOPMENT OF FIRE-RESISTANT, LOW SMOKE GENERATING, THERMALLY STABLE END ITEMS FOR COMMERCIAL AIRCRAFT AND SPACECRAFT USING A BASIC POLYIMIDE RESIN
John Gagliani *In* NASA. Ames Res. Center Conf. on Fire Resistant Mater. Jul. 1979 p 71-92 (For primary document see N79-31166 22-03)
Avail: NTIS HC A13/MF A01 CSCL 01C

Experimental data pertinent to flexible resilient foams, low density wall panels, high strength floor panels and thermal acoustical insulation are presented. An evaluation of the effect of the heterocyclic diamine component on the compression set of the foams was carried out. Processes and compositions for fabricating wall panels were evaluated. Thermal acoustical polyimide materials were developed to replace conventional glass batting insulation. To reduce the thermal stresses and improve the burn through resistance, cross linked polyimide foams were developed but not evaluated. G.Y.

N79-31172*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
GLOBAL ENCLOSURE FIRE MODELING WITH APPLICATIONS
Jay William Stuart *In* NASA. Ames Res. Center Conf. on Fire Resistant Mater. Jul. 1979 p 93-101 (For primary document see N79-31166 22-03)
Avail: NTIS HC A13/MF A01 CSCL 01C

A brief review of LERC (Limiting Energy Release Criteria) is presented. Application of LERC to JSC/Boeing ignition source full-scale tests and to JSC/Dacfir math-model validation tests is outlined. It is concluded that: (1) a complete LERC application to the JSC/Boeing tests verifies the fuel load criterion as the limiting constraint; (2) the variability of magnitude and form of the results of repeated tests with and without small variations in parameters emphasizes the significance of the local flow, species concentration, and heat transfer distribution; and (3) weight loss measurements of recent JSC tests show consistent results with prior methods, fuel load constrained. G.Y.

N79-31173*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ENCLOSURE FIRE DYNAMICS MODEL
Josette Bellan *In* NASA. Ames Res. Center Conf. on Fire Resistant Mater. Jul. 1979 p 103-116 (For primary document see N79-31166 22-03)
Avail: NTIS HC A13/MF A01 CSCL 01C

A practical situation of an enclosure fire is presented and why the need for a fire dynamic model is addressed. The difficulties in establishing a model are discussed, along with a brief review of enclosure fire models available. The approximation of the practical situation and the model developed are presented. G.Y.

N79-31174*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
LARGE-SCALE POOL FIRE TEST RECOMMENDATIONS
C. Perry Bankston *In* NASA. Ames Res. Center Conf. on Fire Resistant Mater. Jul. 1979 p 117-126 (For primary document see N79-31166 22-03)
Avail: NTIS HC A13/MF A01 CSCL 01C

The important aspects of external pool fires are outlined. The research objectives are: (1) determine heat flux to surfaces as a function of pool size (convective and radiative heat flux); (2) obtain information that can be compared with theoretical models for radiative flux in the near field; and (3) predict radiative heat flux for arbitrary pool size. The measurements and instrumentation (calorimeters and thermocouples) used for pool fires are outlined. G.Y.

N79-31175*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
FUSELAGE VENTILATION UNDER WIND CONDITIONS
Jay William Stuart *In* NASA. Ames Res. Center Conf. on Fire Resistant Mater. Jul. 1979 p 127-134 (For primary document see N79-31166 22-03)
Avail: NTIS HC A13/MF A01 CSCL 01C

To determine realistic fuselage ventilation rates for post-crash fires and full-scale fire tests, the effects on wind-about fuselage ventilation rate of various parameters were studied. The parameters investigated were fuselage size and shape, fuselage orientation and proximity to ground, fuselage-opening and location, and wind speed and direction. F.O.S.

N79-31176*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
FIRE RESISTANT AIRCRAFT SEAT PROGRAM
Larry A. Fewell *In its* Conf. on Fire Resistant Mater. Jul. 1979 p 135-166 (For primary document see N79-31166 22-03)
Avail: NTIS HC A13/MF A01 CSCL 01C

Foams, textiles, and thermoformable plastics were tested to determine which materials were fire retardant, and safe for aircraft passenger seats. Seat components investigated were the decorative fabric cover, slip covers, fire blocking layer, cushion reinforcement, and the cushioning layer. F.O.S.

N79-31177*# Boeing Commercial Airplane Co., Seattle, Wash.
A REVIEW OF BOEING INTERIOR MATERIALS AND FIRE TEST METHODS DEVELOPMENT PROGRAMS
Eugene Bara *In* NASA Ames Res. Center Conf. on Fire Resistant Mater. Jul. 1979 p 167-181 (For primary document see N79-31166 22-03)
Avail: NTIS HC A13/MF A01 CSCL 01C

Total materials systems requirements, and government and industry programs are outlined along with a new fire test methodology, and the potential decrease in post crash fire hazards. The flammability, smoke and toxicity goals, and the scope of materials systems are tabulated. F.O.S.

N79-31178*# Boeing Commercial Airplane Co., Seattle, Wash.
FIREMEN PROGRAM Status Report
Roy A. Anderson and Gerald A. Johnson *In* NASA. Ames Res. Center Conf. on Fire Resistant Mater. Jul. 1979 p 183-222 (For primary document see N79-31166 22-03)
Avail: NTIS HC A13/MF A01 CSCL 01C

An overview of the program to improve fire retardant interior panels is presented. The sandwich panel makeup for different components, and the burn test results are presented. F.O.S.

N79-31179*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ADVANCED RESIN MATRICES FOR COMPOSITES
Demetrius A. Kourtides *In its* Conf. on Fire Resistant Mater. Jul. 1979 p 223-238 (For primary document see N79-31166 22-03)
Avail: NTIS HC A13/MF A01 CSCL 01C

The selection criteria, and the chemical structure of resin matrices are given along with the processing conditions for resins and laminates. F.O.S.

N79-31180*# Utah Univ., Salt Lake City.
A COMPARATIVE STUDY OF THE TOXICITY OF THE COMBUSTION PRODUCTS OF TEDLAR AND A FLUORENONE-POLYESTER FILM
David G. Farrar *In* NASA. Ames Res. Center Conf. on Fire Resistant Mater. Jul. 1979 p 239-250 (For primary document see N79-31166 22-03)
Avail: NTIS HC A13/MF A01 CSCL 01C

The relative toxicity in rats resulting from a 30 minute exposure to the combustion products of two materials, Tedlar and fluorenone-polyester film was assessed. The combustion products

were generated into a static exposure system using a laboratory-scale furnace. The toxicity was assessed using the primary measurements employed in a more detailed overall toxicity evaluation. The toxicological events observed during the 30 minute exposure are reported. F.O.S.

N79-31181*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
FIRE AND SMOKE RETARDANT MATERIALS DEVELOPMENT
W. A. Mueller *In* NASA. Ames Res. Center Conf. on Fire Resistant Mater. Jul. 1979 p 251-264 (For primary document see N79-31166 22-03)
Avail: NTIS HC A13/MF A01 CSCL 01C

The research to provide a mechanism for dissipation of impact energy in filled polymers by using fillers with a low modulus coating is reported which will dissipate energy through shearing and crazing instead of fracture. The approach offers the advantages of low cost, low toxicity, and applicability to various resins. F.O.S.

N79-31182*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THERMOCHEMICAL MODELING
Kumar Ramohalli *In* NASA. Ames Res. Center Conf. on Fire Resistant Mater. Jul. 1979 p 265-269 (For primary document see N79-31166 22-03)
Avail: NTIS HC A13/MF A01 CSCL 01C

The prediction of smoke behavior of a material using only the thermochemical properties geometry and flow, was investigated to determine economical methods for producing better materials. Spinoff, and honeycomb sandwich structures are discussed. F.O.S.

N79-31183*# Isovolta Co., Wiener Neudorf (Austria).
THE FLUORENONE POLYESTER ISO FPE OF ISOVOLTA COMPANY, AUSTRIA
H. Weber *In* NASA. Ames Res. Center Conf. on Fire Resistant Mater. Jul. 1979 p 271-282 (For primary document see N79-31166 22-03)
Avail: NTIS HC A13/MF A01 CSCL 01C

Methods for the synthesis of ISO-FPE are described, and the mechanical properties are given. The industrial production of powder and film is discussed. F.O.S.

N79-31184# Air Force Engineering and Services Center, Tyndall AFB, Fla.
AN EVALUATION OF THE BIRD AIRCRAFT STRIKE HAZARD AT HILL AFB, UTAH (AFLC)
Jeffrey J. Short, James S. Kent, Ardrah L. Buddin, III, and William H. Niemeier Jan. 1979 45 p refs
(AD-A070459; AFESC-TM-1-79) Avail: NTIS HC A03/MF A01 CSCL 01/2

Hill Air Base was surveyed from 30 September to 12 October 1978 and from 28 to 30 January 1979 by the Air Force Engineering and Services Center Bird/Aircraft Strike Hazard Bash Team. Insect populations, vegetation, bird activity and local geography were studied to assess the impact of birds on flying operations at the base. GRA

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications*.

N79-31185*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
UHF COPLANAR-SLOT ANTENNA FOR AIRCRAFT-TO-SATELLITE DATA COMMUNICATIONS
Royce W. Myhre 1979 21 p refs Presented at the Printed Circuit Antenna Technol. Workshop, Las Cruces, N. Mex., 17-19 Oct. 1979; sponsored by New Mexico State Univ. and the Army Res. Office Physical Sci. Lab.
(NASA-TM-79239; E-146) Avail: NTIS HC A02/MF A01 CSCL 17B

A lightweight low drag coplanar slot antenna was developed for use on commercial jet aircraft that will provide upper hemisphere coverage in the UHF band at frequencies of 402 and 468 MHz is described. The antenna is designed to transmit meteorological data from wide body jet aircraft to ground users via synchronous meteorological data relay satellites. The low profile antenna (23.5 cm wide by 38.1 cm long slot by 1.9 cm high) is a conformal antenna utilizing the coplanar approach with the advantages of broad frequency bandwidth and improved electrical integrity over wide range of temperature. The antenna is circular polarized, has anon axis gain of near +2.5 dB, and a HPBW greater than 90 deg. Areas discussed include antenna design, radiation characteristics, flight testing, and system performance. K.L.

N79-31186*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
FLIGHT PERFORMANCE OF THE TCV B-737 AIRPLANE AT KENNEDY AIRPORT USING TRSB/MLS GUIDANCE
William F. White and Leonard V. Clark Jul. 1979 29 p refs
(NASA-TM-80148) Avail: NTIS HC A03/MF A01 CSCL 17G

The terminal configured vehicle (TCV) B 737 was flown in demonstration of the time reference scanning beam/microwave landing system (TRSB/MLS). The flight performance of the TCV airplane during the demonstration automatic approaches and landings while utilizing TRSB/MLS guidance is reported. The TRSB/MLS is shown to provide the terminal area guidance necessary for flying curved automatic approaches with short finals. A.W.H.

N79-31187*# Ohio Univ., Athens. Avionics Engineering Center.
DIGITAL PHASE-LOCKED LOOP DEVELOPMENT AND APPLICATION TO LORAN-C
Daryl L. McCall Sep. 1979 14 p refs
(Grant NGR-36-009-017)
(NASA-CR-162283; TM-69) Avail: NTIS HC A02/MF A01 CSCL 17G

A digital phase-locked loop was developed and implemented for use in a low cost Loran C receiver. The digital phase-locked loop design is described and it's application to Loran C is discussed. R.E.S.

N79-31188# Royal Aircraft Establishment, Farnborough (England).
THE SIGNIFICANCE OF THE ELLIPSOID SHAPE OF THE EARTH IN AERIAL NAVIGATION Ph.D. Thesis - Stuttgart Univ.
L. Kiefer Mar. 1979 180 p refs Transl. into ENGLISH from German thesis, Ger. Geodetic Comm. publ. no. 166, ser. C (Munich), 1971
(RAE-Lib-Trans-2001; BR69303) Avail: NTIS HC A09/MF A01

Formulas which take into account the ellipsoid shape of the earth are presented. The formulas were used to analyze measurements used in aerial navigation. The possibility of representing the earth as a sphere was examined and the idea was discarded because calculation errors were so great. A new approximate method is presented of calculating the distance between two widely separated points. Also, astro navigation calculations via elevation sightings were investigated and the accuracy of the calculations was evaluated. R.E.S.

N79-31189# Naval Postgraduate School, Monterey, Calif.
A DEVELOPMENTAL COMPUTER MODEL FOR INVESTIGATIONS OF AIR TRAFFIC MANAGEMENT PROBLEMS: A CASE INVESTIGATING TWO DECISION STRATEGIES M.S. Thesis
John Thomas Malokas, Jr. and Arvid Paul Pederson Mar. 1979 133 p refs
(AD-A071075) Avail: NTIS HC A07/MF A01 CSCL 17/7

A computer simulation model designed to help solve regional air traffic scheduling problems was developed. Bases, mission areas, and aircraft were modeled using the simulation language

SIMSCRIPT. Events in the simulation included takeoffs, departures, enroutes, missions, arrivals at Initial Approach Fixes (IAFs) and landings. To demonstrate potential use of the model, the problem of rescheduling Strategic Air Command (SAC) aircraft upon base closures was addressed. Two strategies for the diversion of such aircraft were developed, implemented and the results compared on the basis of impact on final destination bases and average aircraft airborne time. Strategy 1 entailed the rerouting of aircraft to designated alternate bases or to the nearest open base without constraint. Strategy 2 involved the selection of an alternate base by insuring that parking spaces and appropriate maintenance support were available. Finally, extensions to the model and recommendations are discussed. GRA

N79-31190# National Technical Information Service, Springfield, Va.
LORAN C NAVIGATION. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - May 1979
William E. Reed Jun. 1979 152 p Supersedes NTIS/PS-78/0531, NTIS/PS-77/0336
(NTIS/PS-79/0523/5; NTIS/PS-78/0531; NTIS/PS-77/0336) Avail: NTIS HC $28.00/MF $28.00 CSCL 17G

Research reports are cited on the use of Loran C for air and maritime navigation, including coastal confluence and inland waters; automatic vehicle location and tracking; distress systems; portable land position finding; meteorological and atmospheric data acquisition; time and frequency synchronization; and position fixing. Also included are research on Loran C equipment and signal propagation. This updated bibliography contains 144 abstracts, 21 of which are new entries to the previous edition. GRA

N79-31191# National Technical Information Service, Springfield, Va.
LORAN C NAVIGATION. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - May 1979
William E. Reed Jun. 1979 130 p Supersedes NTIS/PS-78/0532; NTIS/PS-77/0337
(NTIS/PS-79/0524/3; NTIS/PS-78/0532; NTIS/PS-77/0337) Avail: NTIS HC $28.00/MF $28.00 CSCL 17G

The use of Loran C for air and maritime navigation is discussed. Topics covered include both automatic vehicle locating and tracking; meteorological and atmospheric data acquisition; position fixing, and time and frequency synchronization as well as Loran C equipment and signal propagation. This updated bibliography contains 124 abstracts, 15 of which are new entries to the previous edition. GRA

N79-31690# Centre National d'Etudes Spatiales, Toulouse (France). Div. Mathematiques et Traitement.
OMEGA POINT CALCULATOR [CALCULATEUR DE POINTS OMEGA]
J. L. Pieplu, R. Rumeau, and M. Vincent *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 393-395 In FRENCH
(For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics.*

N79-31192*# Lockheed-California Co., Burbank.
TESTING AND ANALYSIS OF DUAL-MODE ADAPTIVE LANDING GEAR, TAXI MODE TEST SYSTEM FOR YF-12A
Max A. Gamon Sep. 1979 54 p refs Sponsored by NASA
(NASA-CR-144884; LR-28776) Avail: NTIS HC A04/MF A01 CSCL 01C

The effectiveness of a dual mode adaptive landing gear system in reducing the dynamic response of an airplane during ground taxiing was studied. The dynamic taxi tests of the YF-12A research airplane are presented. A digital computer program which simulated the test conditions is discussed. The dual mode system as tested provides dynamic taxi response reductions of 25 percent at the cg and 30 to 45 percent at the cockpit. A.W.H.

N79-31193*# Rockwell International Corp., Los Angeles, Calif. Aircraft Div.
RIDE QUALITIES CRITERIA VALIDATION/PILOT PERFORMANCE STUDY: FLIGHT TEST RESULTS Final Report
Louis U. Nardi, Harry Y. Kawana, and David C. Greek Sep. 1979 69 p refs
(Contract NAS4-2542)
(NASA-CR-144885; NA-78-897) Avail: NTIS HC A04/MF A01 CSCL 01C

Pilot performance during a terrain following flight was studied for ride quality criteria validation. Data from manual and automatic terrain following operations conducted during low level penetrations were analyzed to determine the effect of ride qualities on crew performance. The conditions analyzed included varying levels of turbulence, terrain roughness, and mission duration with a ride smoothing system on and off. Limited validation of the B-1 ride quality criteria and some of the first order interactions between ride qualities and pilot/vehicle performance are highlighted. An earlier B-1 flight simulation program correlated well with the flight test results. A.W.H.

N79-31194# Aeronautical Research Labs., Melbourne (Australia).
LOAD SPECTRUM MEASURING EQUIPMENT. PART 1: DETAILS OF MK 1 SYSTEM PRESENTLY USED TO ACQUIRE DATA IN WESSEX MK 31B HELICOPTERS
K. F. Fraser and U. R. Krieser Aug. 1978 54 p refs
(ARL-MECH-ENG-NOTE-371; AR-001-301) Avail: NTIS HC A04/MF A01

Measuring equipment was developed which uses a set of electromechanical counters to indicate the integrated time in seconds for which torque loading on a transmission component falls within each of a number of bands. Separation of the torque level into bands is made possible using a single transducer, an amplifier with zero and gain adjustments for setting the extremes of the torque range of interest, an analogue to digital converter and decoder to separate the torque range into bands and counters to totalize contributions in each band. Author

N79-31195*# Lockheed-Georgia Co., Marietta.
CORRELATION OF DATA RELATED TO SHOCK-INDUCED TRAILING-EDGE SEPARATION AND EXTRAPOLATION TO FLIGHT REYNOLDS NUMBER
J. F. Cahill and P. C. Connor Washington NASA Sep. 1979 82 p refs
(Contract NAS2-9331)
(NASA-CR-3178) Avail: NTIS HC A05/MF A01 CSCL 01C

Pressure data from a number of previous wind tunnel and flight investigations of high speed transport type wings were analyzed with the intent of developing a procedure for extrapolating low Reynolds number data to flight conditions. These analyses produced a correlation of the development of trailing-edge separation resulting from increases in Mach number and/or angle of attack and show that scale effects on this correlated separation development and the resulting shock location changes fall into a regular and apparently universal pattern. Further studies appear warranted to refine the correlation through a detailed consideration of boundary layer characteristics, and to evaluate scale effects on supercritical wings. Author

N79-31196# Naval Postgraduate School, Monterey, Calif.
THE DEVELOPMENT AND EVALUATION OF AN EXPERIMENTAL APPARATUS FOR THE INVESTIGATION OF FASTENER PULL-THROUGH FAILURE IN GRAPHITE-EPOXY LAMINATES M.S. Thesis
Wayne Richard Hanley Mar. 1979 62 p refs
(AD-A070087) Avail: NTIS HC A04/MF A01 CSCL 01/3

This thesis examines the failure at a fastener hole in a composite fuel tank skin due to hydraulic ram i.e., fluid pressure due to a penetrating projectile. An experimental apparatus was set up to investigate the triaxial loading conditions at the fastener hole so that an M-P-N failure surface could be developed for the graphite-epoxy laminate. An expression was derived to

predict the bending moment at the fastener in terms of the pull force on the fastener and the axial force in the plate. Aluminum specimens were tested and the results were compared with the predicted results to validate the experimental procedure. The experimental results were found to not be repeatable, and hence a correlation with the predicted results was not appropriate. The nonrepeatability could not be explained. Composite specimens were fabricated and prepared for testing. Experimental values for the ultimate pure pull force, P, ultimate pure bending moment, M, and ultimate pure axial force, N, were obtained. GRA

N79-31197# Douglas Aircraft Co., Inc., Long Beach, Calif.
EFFECT OF TRANSPORT/BOMBER LOADS SPECTRUM ON CRACK GROWTH Final Technical Report, Sep. 1976 - Sep. 1978
P. R. Abelkis Nov. 1978 217 p refs
(Contract F33615-76-C-3116)
(AD-A069287; AFFDL-TR-78-134) Avail: NTIS HC A10/MF A01 CSCL 01/3

This program investigated analytically and experimentally the effect of transport/bomber loads spectrum variations on crack growth. The spectrum represented a STOL transport (C-15) wing lower surface loading. The 116 spectrum variations were generated, grouped in the following categories: (1) baseline spectra, (2) mission mix, (3) sequence of missions, (4) individual flight length, (5) flight segments, (6) exceedances spectra, (7) design stress level, (8) valley/peak coupling, (9) low load truncation, (10) high infrequent loads, (11) clipping of large loads, (12) miscellaneous variations, and (13) combined variations. Spectra were generated as random cycle-by-cycle, flight-by-flight sequences. Analyses and tests were performed on 7475-T7651 aluminum, to .25 inches, starting with an initial through-the-thickness 0.03-inch crack out of a 1/4-inch diameter hole. Crack growth analysis predictions were made for all 116 spectra using the linear model. Crack growth tests were performed with 33 of these spectra. Good correlation was obtained between analysis and test results in all cases except with spectra dealing with increased frequency and magnitude of high infrequent loads and spectra which were drastically changed from a wing-type to a vertical tail-type spectrum. Largest effects on crack growth life, as measured in flight hours, was due to flight length, mission, mission mix, and design stress level variations. Based on the results of this program, fleetwide crack growth variations by a factor of 100 and 10 could be experienced, depending on whether it was short-term or long-term variation. GRA

N79-31198# Douglas Aircraft Co., Inc., Long Beach, Calif.
A USER'S MANUAL FOR A COMPUTER PROGRAM TO GENERATE FATIGUE SPECTRUM LOADING SEQUENCES Final Technical Report, Sep. 1976 - Sep. 1978
P. R. Abelkis, P. M. Lee, and B. P. Tate Nov. 1978 246 p refs
(Contract F33615-76-C-3116)
(AD-A069288; AFFDL-TR-78-136) Avail: NTIS HC A11/MF A01 CSCL 01/3

The report contains, in the form of a user's manual, the listing and complete description of a computer program to generate fatigue spectrum loading sequences. The program is specifically tailored for the development of random cycle-by-cycle, flight-by-flight loading sequences typical of aircraft structures. However, its general features allow the development of any type spectrum. The random sequence of cycles and flights is produced by a random number generator. Alternate non-random flight sequences can also be generated. The basic input data consists of loads exceedances spectra or data to calculate such spectra by the program. The program contains the following spectrum editing features: (1) truncation - elimination of cycles as a function of range and R, peak or valley, (2) clipping - loads below or above a specified clipping value are set equal to that value, (3) all loads in the spectrum are multiplied by a constant. The output is a valley, peak sequence of the loads spectrum. The spectrum may be read into a magnetic tape to be used in other analyses or in testing. GRA

N79-31199# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
INVESTIGATION OF ROLL PERFORMANCE FOR A HIGHLY NONLINEAR STATICALLY UNSTABLE FIGHTER-TYPE AIRCRAFT M.S. Thesis
Paul L. Vergez Mar. 1979 101 p refs
(AD-A069301; AFIT/GGO/EE/79-4) Avail: NTIS HC A06/MF A01 CSCL 01/3

A linearized model of a fighter-type aircraft with significant roll-pitch inertial coupling, including its full flight control system is required in order to conduct a comparative analysis between body axis rolls and velocity (stability) axis rolls. The stability of the aircraft is checked at various roll rates for both body axis and velocity axis rolls. This is done by examining the signs of the eigenvalues of the linearized model-positive for unstable and negative for stable. It is found that at various angles of attack the velocity axis rolls prove to be at least as stable and, in most cases, more stable than body axis rolls. The stability is also observable for various combinations of flight control systems. In developing a nonlinear coupled equation solver, a single equation with known solutions is considered first. This is done to show a simplified version of what the nonlinear program is required to do. Next, a pair of nonlinear coupled equations is analyzed. The development of the program for the single equation case proves to be successful, but certain problems arise when working with a pair of coupled equations. This thesis provides a good foothold on a method of analysis known as Bifurcation Analysis and Catastrophe Theory which can be used to solve the nonlinear coupled aircraft equations. This thesis presents some of the problems which could be encountered. GRA

N79-31200# Dayton Univ. Research Inst., Ohio.
FUEL TANK SURVIVABILITY FOR HYDRODYNAMIC RAM INDUCED BY HIGH VELOCITY FRAGMENTS. PART 2: NUMERICAL ANALYSES Final Report, Oct. 1977 - Oct. 1978
Sheldon H. Schuster and Jack S. Macales Wright-Patterson AFB, Ohio AFFDL Feb. 1979 104 p Prepared by California Research and Technology, Inc., Woodland Hills
(Contract F33615-77-C-2082; AF Proj. 2402)
(AD-A070128; AFFDL-TR-78-182-Pt-2) Avail: NTIS HC A06/MF A01 CSCL 01/3

Numerical finite difference CRALE and finite element NONSAP calculations of the behavior of fuel tank front panels, penetrated by steel fragments impacting at velocities of 1.0-2.0 km/sec were used to explain the phenomena observed in an accompanying experimental program Part I of this report. Analytic expressions for the variation of peak pressure and impulse along the panel as functions of fragment size, velocity, and panel areal density were derived from the finite difference runs and used as boundary conditions in the finite element calculations of panel failure and displacements. GRA

N79-31201# Douglas Aircraft Co., Inc., Long Beach, Calif.
WINDSHIELD TECHNOLOGY DEMONSTRATOR PROGRAM-CANOPY DETAIL DESIGN OPTIONS STUDY Final Report, Feb. 1977 - Sep. 1978
M. J. Coker, J. B. Hoffman, and J. J. Lawrence, Jr. Wright-Patterson AFB, Ohio AFFDL Sep. 1978 352 p refs
(Contract F33615-75-C-3105; AF Proj. 2202)
(AD-A070376; MDC-J7176; AFFDL-TR-78-114) Avail: NTIS HC A16/MF A01 CSCL 01/3

This report documents the work accomplished for the Windshield Technology Demonstrator Program. The studies, analyses, testing, and development accomplished during this program involved a total system approach required for aircraft canopies in the context of the continuing Air Force generic wind shield development programs. State-of-the-art applications of new transparency materials have been devised from both military and commercial aircraft with major attention directed to the topics of bird impact resistance, structural design integration, systems integration, and design for maintainability and reliability. The authors and Air Force Flight Dynamics Laboratory FEW agree that the various disciplines and essential technical design concepts represented, including associated reports noted in Section IV, should all be utilized in arriving at an optimum design of the canopy system for any production aircraft. GRA

N79-31202# Dayton Univ., Ohio. Research Inst.
FUEL TANK SURVIVABILITY FOR HYDRODYNAMIC RAM INDUCED BY HIGH VELOCITY FRAGMENTS. PART 1:

EXPERIMENTAL RESULTS AND DESIGN SUMMARY Final Report, Sep. 1977 - Oct. 1978
S. J. Bless Wright-Patterson AFB, Ohio AFFDL Jan. 1979 127 p refs
(Contract F33615-77-C-2082; AF Proj. 2402)
(AD-A070113; UDR-TR-78-115-Pt-1; AFFDL-TR-78-182-Pt-1) Avail: NTIS HC A07/MF A01 CSCL 01/3

Failure data, displacement data, and pressure data were obtained from laboratory experiments. Panels were made from 7075- T6 and 2024- T3 aluminum and from graphite epoxy panel thicknesses were 1.6 to 6.35 mm. Protection included 10 mm ballistic foam and stiffeners. Projectiles were 5.6 g and 11.7 g spheres and cubes. Failures were always catastrophic, and failure thresholds were always abrupt. When cracks formed, they ran across the panels, except when stiffeners were present. In thin panels, cracks initiated at the corners of the perforation when cubical fragments were used. The entrance panel damage was primarily induced by the shock wave generated by the impact. The very high shock pressure resulted in impulsive loading of the panels that caused prompt crack formation. Cracks were propagated by the displacement field. GRA

N79-31203# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
EVALUATION OF F-111 WEAPON BAY AERO-ACOUSTIC AND WEAPON SEPARATION IMPROVEMENT TECHNIQUES Final Technical Report, 1 May 1976 - 1 Aug. 1978
Rodney L. Clark Feb. 1979 150 p refs
(AF Proj. 2404)
(AD-A070253; AFFDL-TR-79-3003) Avail: NTIS HC A07/MF A01 CSCL 01/3

Several aero-acoustic suppression devices have been evaluated which were considered feasible for installation on an F-111 aircraft for flight test evaluation. The most promising modification consists of a saw tooth spoiler mounted at the leading edge of the weapon bay. This device would be erected to a 90 degree position during the bay doors opening sequence. The spoiler is folded flush with the fuselage during all other flight conditions. Wind tunnel tests have shown that this spoiler improves the aero-acoustic environment within the open weapon bay and improves the weapon separation characteristics over the Mach range of .95 to 1.3 investigated during the drop test phase. GRA

N79-31204# Argonne National Lab., Ill.
ANALYSIS OF PLUME RISE FROM JET AIRCRAFT
R. J. Yamartino, J. Lee, S. Bremer, D. Smith, and J. Calman 1979 7 p refs Presented at the 4th Symp. on Turbulence, Diffusion and Air Pollution, Boston, 15-18 Jan. 1979 Sponsored in part by FAA and Air Force Prepared in cooperation with Environmental Research and Technology, Lexington, Mass.
(Contract W-31-109-eng-38)
(CONF-790142-1) Avail: NTIS HC A02/MF A01

Preliminary results of an investigation of the behavior of buoyant jet engine exhaust plumes in a crosswind are discussed and attempts are made to identify the degree to which the plume rise can be described by relationships developed for other types of sources. At least four factors were found to affect the rate of dilution of jet exhaust before it reached receptors adjacent to taxiways or runways: (1) turbulent mixing of the jet exhaust at the engine exit; (2) buoyant plume rise; (3) advective dilution; and (4) dispersion by ambient turbulence. DOE

N79-31701# Observatoire de Paris-Meudon (France).
SPACE RESEARCH WITH AIRBORNE PLATFORMS
P. Lena and D. Rouan *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 461-465 refs (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N79-31205# Arinc Research Corp., Annapolis, Md.
RELIABILITY IMPROVEMENT WARRANTY TERMS AND CONDITIONS FOR THE INTEGRATED AVIONICS CONTROL SYSTEMS (IACS) Final Report, Jan. - Mar. 1979
Larry Cox May 1979 44 p
(Contract DAAB07-78-A-6606)
(AD-A069454; Rept-1573-01-1-1927) Avail: NTIS HC A03/MF A01 CSCL 01/3

The Advanced Systems Division of the U.S. Army Avionics Research and Development Activity at Fort Monmouth, New Jersey, has issued Engineering Development (ED) contracts to two contractors for the Integrated Avionics Control System (IACS). One of the features of the ED progam will be a complete logistics support analysis (LSA) of Reliability Improvement Warranty (RIW) as an alternative to Army organic support. ARINC Research Corportion assisted the IACS Project Office in the development of draft RIW terms and conditions on which the LSA will be based. This report presents the activities that were performed and describes the draft RIW and conditions that were developed. GRA

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N79-31206*# National Aeronautics and Space Administration, Washington, D. C.
INVESTIGATION OF AIR STREAM FROM COMBUSTOR-LINER AIR ENTRY HOLES, 3
Tetsuro Aiba and Tokuji Nakano Aug. 1979 37 p refs Transl. into ENGLISH of "Ko fuka nenshoki no kukiko kara no nagare ni tsuite, 3" Natl. Aerospace Lab., Tokyo, NAL-TR-369, 1974 23 p Original language document was announced as N75-17358 Transl. by Scientific Translations Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75430; NAL-TR-369) Avail: NTIS HC A03/MF A01 CSCL 21E

Jets flowing from air entry holes of the combustor liner of a gas turbine were investigated. Cold air was supplied through the air entry holes into the primary hot gas flows. The mass flow of the primary hot gas and issuing jets was measured, and the behavior of the air jets was studied by the measurement of the temperature distribution of the gas mixture. The air jets flowing from three circular air entry holes, single streamwise long holes, and two opposing circular holes, parallel to the primary flow were studied along with the effects of jet and gas stream velocities, and of gas temperature. The discharge coefficient, the maximum penetration of the jets, the jet flow path, the mixing of the jets, and temperature distribution across the jets were investigated. Empirical expressions which describe the characteristics of the jets under the conditions of the experiments were formulated. A.W.H.

N79-31207*# General Electric Co., Cincinnati, Ohio.
EXPERIMENTAL CLEAN COMBUSTOR PROGRAM (ECCP), PHASE 3 Final Report
C. C. Gleason and D. W. Bahr 1 Jun. 1979 201 p refs
(Contract NAS3-19736)
(NASA-CR-135384; R79AEG410) Avail: NTIS HC A10/MF A01 CSCL 21E

A double annular advanced technology combustor with low

pollutant emission levels was evaluated in a series of CF6-50 engine tests. Engine lightoff was readily obtained and no difficulties were encountered with combustor staging. Engine acceleration and deceleration were smooth, responsive and essentially the same as those obtainable with the CF6-50 combustor. The emission reductions obtained in carbon monoxide, hydrocarbons, and nitrogen oxide levels were 55, 95, and 30 percent, respectively, at an idle power setting of 3.3 percent of takeoff power on an EPA parameter basis. Acceptable smoke levels were also obtained. The exit temperature distribution of the combustor was found to be its major performance deficiency. In all other important combustion system performance aspects, the combustor was found to be generally satisfactory. K.L.

N79-31208*# Pratt and Whitney Aircraft, East Hartford, Conn. Commercial Products Div.

JT9D-70/59 IMPROVED HIGH PRESSURE TURBINE ACTIVE CLEARANCE CONTROL SYSTEM

W. O. Gaffin 8 Jun. 1979 66 p ref

(Contract NAS8-20630)

(NASA-CR-159661; PWA-5515-87C) Avail: NTIS HC A04/MF A01 CSCL 21E

The JT9D-70/59 high pressure turbine active clearance control system was modified to provide reduction of blade tip clearance when the system is activated during cruise operation. The modification increased the flow capacity and air impingement effectiveness of the cooling air manifold to augment turbine case shrinkage capability, and increased responsiveness of the airseal clearance to case shrinkage. The simulated altitude engine testing indicated a significant improvement in specific fuel consumption with the modified system. A 1000 cycle engine endurance test showed no unusual wear or performance deterioration effects on the engine or the clearance control system. Rig tests indicated that the air impingement and seal support configurations used in the engine tests are near optimum. K.L.

N79-31209# National Aviation Facilities Experimental Center, Atlantic City, N. J.

EXHAUST EMISSION TRAVERSE INVESTIGATION OF A JT3D-1 TURBOFAN ENGINE Final Report, Jan. 1975 - Aug. 1978

Gerald R. Slusher Jun. 1979 55 p refs

(FAA Proj. 201-521-100)

(AD-A072019; FAA-RD-79-23; FAA-NA-79-10) Avail: NTIS HC A04/MF A01 CSCL 21/5

The emissions in the exhaust plume of a JT3D-1 turbofan engine were investigated to optimize the shape, size, and location of fixed probes for acquiring representative emission samples. Traverse measurements of 153 points over the exhaust nozzle were accomplished with the sample points located in the corners of two inch squares forming a traverse grid. The average emission levels, contours, and profile distributions were determined. The predicted performances of area weighted cruciform and diamond probe designs were calculated from interpolations of the traverse contours. A.W.H.

N79-31210*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

AN OVERVIEW OF NASA RESEARCH ON POSITIVE DISPLACEMENT TYPE GENERAL AVIATION ENGINES

E. E. Kempke and E. A. Willis 1979 40 p refs Presented at the Aircraft Systems and Technol. Meeting N. Y., 20-22 Aug. 1979; sponsored by AIAA

(NASA-TM-79254; E-165; AIAA-79-1824) Avail: NTIS HC A03/MF A01 CSCL 21E

The general aviation positive displacement engine program encompassing conventional, lightweight diesel, and rotary combustion engines is described. Lean operation of current production type spark ignition engines and advanced alternative engine concepts are emphasized. J.M.S.

N79-31211# National Aviation Facilities Experimental Center, Atlantic City, N. J.

EXHAUST EMISSIONS CHARACTERISTICS FOR A GENERAL AVIATION LIGHT AIRCRAFT TELEDYNE CONTINENTAL MOTORS TSIO-360-C PISTON ENGINE Final Report

Eric E. Becker May 1979 78 p refs

(FAA Proj. 201-521-100)

(AD-A070010; FAA-RD-79-14; FAA-NA-79-3) Avail: NTIS HC A05/MF A01 CSCL 21/2

The TSIO-360-C engine (S/N 300244) was tested to develop an exhaust emissions data base. This data base consists of currents of current production baseline emissions characteristics, lean-out emissions data, effects of leaning-out the fuel schedule on cylinder head temperatures, and data showing ambient effects on exhaust emissions and cylinder head temperatures. The engine operating with its current full-rich production fuel schedule could not meet the proposed Environmental Protection Agency (EPA) standard for carbon monoxide (CO) and unburned hydrocarbons (HC) under sea level standard-day conditions. The engine did, however, meet the proposed EPA standard for oxides of nitrogen (NOX) under the same sea level conditions. The results of engine testing under different ambient conditions (essentially sea level standard day to sea level hot day) are also presented, and these results show a trend toward higher levels of emissions output for CO and HC while producing slightly lower levels of NOX. J.M.S.

N79-31212*# United Technologies Corp., East Hartford, Conn.

AERODYNAMIC AND ACOUSTIC INVESTIGATION OF INVERTED VELOCITY PROFILE COANNULAR EXHAUST NOZZLE MODELS AND DEVELOPMENT OF AERODYNAMIC AND ACOUSTIC PREDICTION PROCEDURES Final Report

Richard S. Larson, Douglas P. Nelson, and Bradley S. Stevens Washington NASA Aug. 1979 223 p refs

(Contract NAS3-20061)

(NASA-CR-3168; PWA-5550-8) Avail: NTIS HC A10/MF A01 CSCL 21E

Five co-annular nozzle models, covering a systematic variation of nozzle geometry, were tested statically over a range of exhaust conditions including inverted velocity profile (IVP) (fan to primary stream velocity ratio >1) and non IVP profiles. Fan nozzle pressure ratio (FNPR) was varied from 1.3 to 4.1 at primary nozzle pressure ratios (PNPR) of 1.53 and 2.0. Fan stream temperatures of 700 K (1260 deg R) and 1089 K(1960 deg R) were tested with primary stream temperatures of 700 K (1260 deg R), 811 K (1460 deg R), and 1089 K (1960 deg R). At fan and primary stream velocities of 610 and 427 m/sec (2000 and 1400 ft/sec), respectively, increasing fan radius ratio from 0.69 to 0.83 reduced peak perceived noise level (PNL) 3 dB, and an increase in primary radius ratio from 0 to 0.81 (fan radius ratio constant at 0.83) reduced peak PNL an additional 1.0 dB. There were no noise reductions at a fan stream velocity of 853 m/sec (2800 ft/sec). Increasing fan radius ratio from 0.69 to 0.83 reduced nozzle thrust coefficient 1.2 to 1.5% at a PNPR of 1.53, and 1.7 to 2.0% at a PNPR of 2.0. The developed acoustic prediction procedure collapsed the existing data with standard deviation varying from + or - 8 dB to + or - 7 dB. The aerodynamic performance prediction procedure collapsed thrust coefficient measurements to within + or - .004 at a FNPR of 4.0 and a PNPR of 2.0. Author

N79-31213*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

AERODYNAMIC PERFORMANCE OF 1.38-PRESSURE-RATIO, VARIABLE-PITCH FAN STAGE

Royce D. Moore and Walter M. Osborn Sep. 1979 71 p

(NASA-TP-1502; E-9700) Avail: NTIS HC A04/MF A01 CSCL 21E

The performance of a variable pitch fan stage tested over a range of blade setting angles, speeds, and flows is presented. The fan was designed for a tip speed of 289.6 m/sec and a flow of 29.6 kg/sec. The measured performance agreed reasonably well with the design point. The stall margin was only 5 percent. Static thrust values along an operating line ranged from less than 15 to over 115 percent of that at design angle as the blade setting angle was varied from 25 degrees (closed) to -8 degrees (opened). The use of casing treatment increased the stall margin to 20.6 percent but decreased efficiency by 4 percentage points. A.W.H.

N79-31214*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

AERODYNAMIC PERFORMANCE OF AXIAL-FLOW FAN

STAGE OPERATED AT NINE INLET GUIDE VANE ANGLES

Royce D. Moore and Lonnie Reid Sep. 1979 43 p refs
(NASA-TP-1510; E-9714) Avail: NTIS HC A03/MF A01 CSCL 21E

The overall performance of a fan stage with nine inlet guide vane angle settings is presented. These data were obtained over the stable flow range at speeds from 60 to 120 percent of design for vane setting angles from -25 to 42.5 degrees. At design speed and design inlet guide vane angle, the stage has a peak efficiency of 0.892 at a pressure ratio of 1.322 and a flow of 25.31 kg/s. The stall margin based on peak efficiency and stall was 20 percent. Based on an operating line passing through the peak efficiency point at the design setting angle, the useful operating range of the stage at design speed is limited by stall at the positive setting angles and by choke at the negative angles. At design the calculated static thrust along the operating line varied from 68 to 114 percent of that obtained at design setting angle. Author

N79-31215*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

CONCEPTUAL STUDY OF A TURBOJET/RAMJET INLET

John P. Weidner Washington Sep. 1979 25 p refs
(NASA-TM-80141; L-13036) Avail: NTIS HC A02/MF A01 CSCL 21A

An inlet concept for separate turbojet and ramjet engines was defined and compared with an equivalent inlet for a wraparound turboramjet engine. The comparison was made for a typical high altitude hypersonic cruise vehicle where the turbojet inlet capture area was required to be half as large as the ramjet inlet capture area at cruise. The use of a shorter nacelle having substantially lower cooling requirements at cruise for the inlet concept for separate turbojet and ramjet engines is suggested. The separate engine concept better isolates the turbojet from the ramjet, requires no special close off mechanisms within the turbojet, and avoids the circumferential heat load imposed by a wraparound ramjet. A more variable geometry is required.
A.W.H.

N79-31216# North Carolina State Univ. at Raleigh. Engineering Design Center.

AN ACTUATOR DISK ANALYSIS OF AN ISOLATED ROTOR WITH DISTORTED INFLOW Progress Report, Jan. 1976 - Dec. 1978

John N. Perkins 31 Mar. 1979 31 p Prepared in cooperation with United Technologies Research Center, E. Hartford, Conn.
(Contract F44620-76-C-0055)
(AD-A069884; NCSU/EDC-79-1) Avail: NTIS HC A03/MF A01 CSCL 21/5

An analytical study of the passage of distorted flow through an isolated, high hub-tip ratio axial compressor is reported. The analysis involves the coupling of the unsteady blade row aerodynamic response (with the flow immediately upstream of the blade row prescribed) with the unsteady duct flow both upstream and downstream of the blade row under the influence of the blade row loading. The numerical solution uses a starting procedure which does not require the inlet plane to be far enough upstream to be unaffected by the presence of the blade row. Hence any experimentally determined distortion at any arbitrary distance upstream of the blade row can be modelled. The results obtained indicate that the predicted pressure profile at the blade row exit is strongly dependent on the experimentally determined steady-state loss and exit flow angle curves, but is almost independent of the magnitude of the first order lag coefficient used to represent the boundary layer time delay through the blade passages. GRA

N79-31217# RAND Corp., Santa Monica, Calif.

AIRCRAFT TURBINE ENGINE MONITORING EXPERIENCE: IMPLICATIONS FOR THE F100 ENGINE DIAGNOSTIC SYSTEM PROGRAM Interim Report, 1977 - 1978

J. L. Birkler and J. R. Nelson Apr. 1979 45 p refs
(Contract F49620-77-C-0023)
(AD-A069282; RAND/R-2391-AF) Avail: NTIS HC A03/MF A01 CSCL 20/5

This briefing report examines the experience gained from several aircraft turbine engine monitoring systems used over the last decade and a half and the implications of that experience for a new monitoring system--the Engine Diagnostic System--under development for the F100 engine on the F-15 and F-16 tactical fighter aircraft. The examination reveals that two different approaches to engine monitoring have evolved in attempts to achieve the goal of improved engine operations, maintenance, and management while reducing support costs. The first concentrates on short-term operations and maintenance aspects and is usually accomplished by recording inflight data in a snapshot mode, i.e., a few seconds of data either at predefined performance windows or when certain engine operating limits are exceeded. The second approach focuses on long-term design-oriented benefits through improved knowledge of the engine operating environment. To achieve the design-oriented benefits, data must be recorded continuously on at least a few aircraft at each operational location. GRA

N79-31218# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.

AMBIENT CORRECTION FACTORS FOR AIRCRAFT GAS TURBINE IDLE EMISSIONS Technical Report, Jan. 1975 - Oct. 1978

William S. Blazowski and Joel W. Marzeski Mar. 1979 67 p refs Presented at the ASME Gas Turbine Conf., New Orleans, Mar. 1976
(AF Proj. 3048)
(AD-A069240; AFAPL-TR-79-2019) Avail: NTIS HC A04/MF A01 CSCL 20/5

Recent investigations have indicated that aircraft engine exhaust emissions are sensitive to ambient conditions. This paper reports on combustor rig testing intended to evaluate variations due to ambient temperature and pressure with special emphasis on idle engine operating conditions. Empirically determined CO, C sub x, H sub y, and NO sub x correction factors--the ratio of the pollutant emission index value obtained during standard day operation to that resulting during actual ambient conditions--are presented. The effects of engine idle cycle pressure ratio, primary zone fuel-air ratio, and fuel type were investigated. Ambient temperature variations were seen to cause substantial emission changes; correction factors in excess of 2.0 were determined in some cases. Ambient pressure variations were found to be less substantial. A previously published NO sub x emission model and a simplified hydrocarbon combustion analysis are shown to be in general agreement with the empirical results. GRA

N79-31219# General Electric Co., Lynn, Mass. Aircraft Engine Group.

DEVELOPMENT OF HOT ISOSTATICALLY PRESSED RENE 95 TURBINE PARTS, ADDENDUM, PHASE 2 Final Report, 1976 - 1978

P. S. Mathur and J. L. Bartos Apr. 1979 44 p ref Addendum to USAAMRDL-TR-76-30
(Contract DAAJ02-73-C-0106)
(AD-A069979; USARTL-TR-78-56-Add; USAAMRDL-TR-76-30) Avail: NTIS HC A03/MF A01 CSCL 21/5

This report deals with the results of Task 6 - Cooling Rate Analysis for Optimum Properties - of Contract DAAJ02-73-C0106, Phase 2, amied at better understanding the critical heat treatment involved in the powder metallurgy production process for manufacturing premium quality hot isostatically pressed As- hip Rene 95 engine hardware. The initial heat treatment study on test blocks and test specimens determined in the effect of section size, quench media, and solution temperature on cooling rate from two different solution temperatures. The correlation between cooling rate microstructure and mechanical property was then established using test specimens. The turbine disks heat treated with different solution temperatures, quench media, and with or without a bore hole defined the most desirable heat treatment parameters for achieving properties. The disks, first heat treated improperly but followed by the selected heat treatment, revealed that the double heat treatment may improve the mechanical properties of the disks initially heat treated improperly.
Author (GRA)

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N79-31220*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
ANALYSIS OF A LATERAL PILOT-INDUCED OSCILLATION EXPERIENCED ON THE FIRST FLIGHT OF THE YF-16 AIRCRAFT
John W. Smith Sep. 1979 53 p refs
(NASA-TM-72867) Avail: NTIS HC A04/MF A01 CSCL 01C

In order to compare and assess potential improvements, two control systems were modeled; the original first flight or prototype aircraft system, and a modification of the prototype system, which essentially reduced the overall gain for the takeoff and landing phase. In general, the overall system gain reduction of the modified flight control system was sufficient to avoid lateral pilot-induced oscillation tendencies. Lowering the system gain reduced the tendency to rate saturate, which resulted in correspondingly higher critical pilot gains for the same control input. Author

N79-31221*# Honeywell Systems and Research Center, Minneapolis, Minn.
HELICOPTER HIGH GRAIN CONTROL Final Report
Thomas B. Cunningham and Edwin C. Nunn Jul. 1979 171 p refs
(Contract NAS1-14789)
(NASA-CR-159052; HONEYWELL-79SRC33) Avail: NTIS HC A08/MF A01 CSCL 01C

High gain control is explored through a design study of the CH-47B helicopter. The plans are designed to obtain the maximum bandwidth possible given the hardware constraints. Controls are designed with modal control theory to specific bandwidths and closed loop mode shapes. Comparisons are made to an earlier complementary filter approach. Bandwidth improvement by removal of limitations is explored in order to establish hardware and mechanization options. Improvements in the pitch axis control system and in the rate gyro sensor noise characteristics in all axes are discussed. The use of rotor state feedback is assessed. A.W.H.

N79-31222*# Systems Technology, Inc., Mountain View, Calif.
A COMPILATION AND ANALYSIS OF HELICOPTER HANDLING QUALITIES DATA. VOLUME 2: DATA ANALYSIS
Robert K. Heffley Aug. 1979 176 p refs
(Contract NAS2-9344)
(NASA-CR-3145; TR-1087-2-Vol-2) Avail: NTIS HC A09/MF A01 CSCL 01C

A compilation and an analysis of helicopter handling qualities data are presented. Multiloop manual control methods are used to analyze the descriptive data, stability derivatives, and transfer functions for a six degrees of freedom, quasi static model. A compensatory loop structure is applied to coupled longitudinal, lateral and directional equations in such a way that key handling qualities features are examined directly. A.W.H.

N79-31223*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
THEORETICAL AND EXPERIMENTAL INVESTIGATION OF GROUND-INDUCED EFFECTS FOR A LOW-ASPECT-RATIO HIGHLY SWEPT ARROW-WING CONFIGURATION
Paul L. Coe, Jr. and James L. Thomas Washington Sep. 1976 102 p refs
(NASA-TP-1508; L-13088) Avail: NTIS HC A06/MF A01 CSCL 01C

An investigation was conducted in a V/STOL tunnel to determine the influence of ground proximity on the aerodynamic characteristics of a low-aspect-ratio highly swept arrow-wing configuration. The experimental results showed that as the height above the ground decreases, the configuration experiences substantial increases in lift and reductions in induced drag. Although a significant percentage of these ground-induced performance improvements are lost due to trim requirements, the net performance improvement remains quite favorable. The tests also showed that decreasing ground height results in a substantial increase in the horizontal-tail contribution to longitudinal stability. Comparison of the experimental results with results predicted by a planar vortex-lattice theoretical model shows that the theoretical model provides a good estimate of the ground-induced effect on lift, drag, and longitudinal stability for the wing-body combination. However, the theoretical model does not adequately predict either the zero lift pitching moment or the horizontal-tail downwash characteristics. Author

N79-31224# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
THE DESIGN OF DIGITAL CONTROLLERS FOR THE C-141 AIRCRAFT USING ENTIRE EIGENSTRUCTURE ASSIGNMENT AND THE DEVELOPMENT OF AN INTERACTIVE COMPUTER DESIGN PROGRAM M.S. Thesis
Thomas A. Kennedy Mar. 1979 194 p refs
(AD-A069192; AFIT/GGC/EE/79-1) Avail: NTIS HC A09/MF A01 CSCL 01/2

In this report, a deadbeat tracker and regulator are developed for the C-141 aircraft for three different flight conditions using the method of entire eigenstructure assignment. A heuristic iterative method is presented for determining an 'optimal' sampling time for deadbeat controllers by using the controllability matrix. In order to perform the above designs and to evaluate them through a continuous-time simulation, a computer aided design program is developed. This program allows the complete design and simulation of regulator, tracker, and disturbance rejection control systems with full-order observers. In addition, the program permits complete state-space analysis of the system being designed, including both discrete and continuous-time responses. A user's manual and programmer's guide are provided for further development of the program. GRA

N79-31225# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
INVESTIGATION OF INVERSE VANDERMONDE MATRIX CALCULATION FOR LINEAR SYSTEM APPLICATIONS M.S. Thesis
Donald Paul Seyler Mar. 1979 178 p refs
(AD-A069241; AFIT/GGC/EE/79-2) Avail: NTIS HC A09/MF A01 CSCL 12/1

Efficient inversion of a 2n x 2n Vandermonde matrix is a key requirement of a new algorithm developed for parameter identification in linear time-invariant systems. It has features very desirable for application to large systems with many unknown parameters, such as adaptive flight control systems. A generalized algorithm for inverting the Vandermonde matrix was proposed. It was chosen for study because its structure parallels that of the first algorithm. The algorithm was coded into a computer subroutine called 'VANINV', and 43 eigensystems were used to test its computational accuracy and efficiency. Four potential problem areas tested were: large system orders, eigenvalues near each other, eigenvalues near zero, and eigenvalues with large magnitude differences. For a comparison, the Vandermonde matrix for each system was also inverted using routines from the International Mathematical and Statistical Library (IMSL). Test results indicated that VANINV is not quite as fast or as accurate as the IMSL routines. However, the tests were limited to systems with real distinct eigenvalues because the IMSL routines cannot handle other types. VANINV in its present form can handle systems having any combination of complex and/or repeated eigenvalues. Therefore, recommendations for further research and several possible means of improving VANINV are outlined. GRA

N79-31226# Honeywell, Inc., St. Louis Park, Minn. Avionics Div.
PROGRAM FOR THE CRITICAL COMPONENTS OF A FLY-BY-TUBE BACKUP FLIGHT CONTROL SYSTEM, PART 1 Final Report, 1 Jan. - 15 Dec. 1978
Walter M. Posingies 15 Jan. 1979 121 p
(Contract N62269-78-C-0003)
(AD-A070387; W0471-FR1-Pt-1; NADC-77197-60-Pt-1) Avail: NTIS HC A06/MF A01 CSCL 01/3

This report presents the results of a program to develop two of the critical components in an advanced fluidic backup primary flight control system defined as the fly-by-tube concept.

Components developed include an input transducer, which converts pilot commands into hydraulic differential pressure signals, and fluidic resistor networks that sum these hydraulic signals together to provide the required servoactuator commands. Results show that this concept which uses signal levels up to 400 PSID is accurate, linear, quiet, simple, low cost, relatively insensitive to changes in fluid viscosity, and has a stable null with adequate response. GRA

N79-31227# Systems Control, Inc., Palo Alto, Calif.
PATH CONTROLLERS: UNIFICATION OF CONCEPTS AND COMPARISON OF DESIGN METHODS Final Technical Report, Sep. 1977 - Sep. 1978
J. E. Jones and J. S. Karmarkar Dec. 1978 123 p refs
(Contract F33615-77-C-3079; AF Proj. 2403)
(AD-A070252; AFFDL-TR-78-178) Avail: NTIS HC A06/MF A01 CSCL 01/3

This report documents the basic theme of a series of seminars presented to the Air Force Flight Dynamics Laboratory concerning the role of modern control theory in advanced aircraft guidance and control concepts. The report discusses a number of optimal guidance and control concepts as cast in a path-control formal structure. Trajectory generation concepts include horizontal guidance with and without controlled time of arrival, threat avoidance, performance optimization, and terrain following. Control concepts include linear optimal control and classical techniques. Research areas of high potential payoff are identified. GRA

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space).*

N79-31228* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SEAT CUSHION TO PROVIDE REALISTIC ACCELERATION CUES TO AIRCRAFT SIMULATOR PILOT Patent
Billy R. Ashworth, inventor (to NASA) Issued 14 Aug. 1979 10 p Filed 26 Jul. 1978 Supersedes N78-30821 (16 - 21 p 2857) Continuation-in-part of abandoned US Patent Appl. SN-829314, filed 31 Aug. 1977
(NASA-Case-LAR-12149-2; US-Patent-4,164-079; US-Patent-Appl-SN-829314; US-Patent-Appl-SN-928131; US-Patent-Class-35-12E; US-Patent-Class-35-12H) Avail: US Patent and Trademark Office CSCL 14B

Seat cushions, each including an air cell with a non-compressible surface, are disclosed. The apparatus are provided for initially controlling the air pressure in the air cells to allow the two main support areas of the simulator pilot to touch the non-compressible surface and thus begin to compress the flesh near these areas. During a simulated flight the apparatus control the air pressure in the cells to simulate the events that occur in a seat cushion during actual flight. Author

N79-31229# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany).
CONTRIBUTIONS TO EXPERIMENTAL FLUID MECHANICS [BEITRAGE ZUR EXPERIMENTELLEN STROMUNGSMECHANIK]
1977 216 p refs In GERMAN
Avail: NTIS HC A10/MF A01

Various aspects of the reconstruction of aerodynamics testing facilities in West Germany following World War 2 are described in this festschrift honoring Dr. Hubert Ludwieg. His contributions in the development of the high-speed wind tunnel, the 1m x 1m wind tunnel, and the transonic turbine nozzle are stressed. Experiments in spiral flow stability and the application of heated surface elements (films) to measure shear stress on the wall in the three dimensional boundary layer are also discussed. A biography of the scientist a. l a list of his scientific publications is included. A.R.H.

N79-31230*# National Aeronautics and Space Administration, Washington, D. C.
WIND TUNNELS WITH ADAPTED WALLS FOR REDUCING WALL INTERFERENCE
U. Ganzer Aug. 1979 14 p refs Transl. into ENGLISH of Z. fur Flugwissenchaften und Weltraumforschung (West Germany), v 3, no. 2, 1979 p 129-133 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Aero-Space Inst. of Berlin (West Germany)
(Contract NASw-3199)
(NASA-TM-75501) Avail: NTIS HC A02/MF A01 CSCL 14B

The basic principle of adaptable wind tunnel walls is explained. First results of an investigation carried out at the Aero-Space Institute of Berlin Technical University are presented for two dimensional flexible walls and a NACA 0012 airfoil. With five examples exhibiting very different flow conditions it is demonstrated that it is possible to reduce wall interference and to avoid blockage at transonic speeds by wall adaptation.Author

N79-31231# Federal Aviation Administration, Washington, D. C.
POTENTIAL CLOSURE OF AIRPORTS
Jan. 1978 40 p
Avail: NTIS HC A03/MF A01

Airports which are expected to be converted to nonaviation use are identified and measures are suggested to forstall this in cases where the airports involved could help meet transportation and community objectives. The problems cited for the closings are high property taxes, and the high cost of capital improvements and airfield maintenance. Measures examined to aid airports are tax exemptions, zoning and land use controls, and financial aid to assist airport development and maintenance. A.W.H.

N79-31232# Federal Aviation Administration, Washington, D. C.
ADVISORY CIRCULAR. THE PLANNING GRANT PROGRAM FOR AIRPORTS
31 Jan. 1979 75 p
(AC150/5900-1B) Avail: NTIS HC A05/MF A01

The process for applying for grants to prepare airport system plans and airport master plans is described as well as the administrative procedures to be followed in performing planning projects. R.E.S.

N79-31233# Naval Air Engineering Center, Lakehurst, N.J.
SURVEYS OF GROOVES IN 19 BITUMINOUS RUNWAYS Final Report
Richard Melone Mar. 1979 60 p refs
(Contract FA74WAI-423; FAA Proj. 082-431-02)
(AD-A069889; FAA-RD-79-28; NAEC-TD-Misc-R8) Avail: NTIS HC A04/MF A01 CSCL 01/5

The extent and frequency of problems, such as chipping, cracking, rounding, wearing, distorting, and contaminating of the runway grooves were determined. A total of ten different problem areas was identified during the survey with wear, running together (closing), and rubber deposits being the most serious of the ten. In general, the grooves were in satisfactory condition and did not result in abnormal deterioration of runway surfaces. Three of the 19 runways surveyed appeared in need of resurfacing and/or regrooving. Groove depths averaged less than the required 1/4 inch, while groove width and pitch measured close to specified dimensions. M.M.M.

N79-31234# Mitre Corp., McLean, Va. METREK Div.
RUNWAY CONFIGURATION MANAGEMENT SYSTEM CONCEPTS Final Report
A. N. Sinha and R. L. Fain May 1979 20 p refs
(Contract DOT-FA79WA-4184)
(AD-A069960; MP-79W00018) Avail: NTIS HC A02/MF A01 CSCL 01/5

Airport congestion is a problem at the busy airports in the U. S. today. Even under moderate growth projections, the problem of increasing delays will worsen at these busy airports, and will spread to other airports which would approach saturation conditions. While long term relief to the congestion problem would be provided by technological improvements, it is essential to fully and efficiently utilize the existing facilities to avoid

excessive delays in the near term. This paper addresses the problem of selecting optimal runway configurations to minimize delays through the use of a Runway Configuration Management System. Three concepts of this system are developed to represent the full range of static and dynamic configuration selection processes. The basic model, representing the first level concept, has been developed for Chicago O'Hare International Airport. The applicaton of the model at O'Hare and its possible extensions are also discussed. GRA

N79-31235# Decision Science, Inc., San Diego, Calif.
TACTICAL PERFORMANCE CHARACTERIZATION BASIC METHODOLOGY Final Report, Dec. 1977 - Sep. 1978
Michael J. Walsh, George H. Burgin, and Lawrence J. Fogel May 1979 65 p refs
(Contract F33615-78-C-0011)
(AD-A069297; AFHRL-TR-78-94) Avail: NTIS HC A04/MF A01 CSCL 05/9

This effort is to develop new methods of characterizing important features of tactical performance for display at an instructor/operator station of a flight simulator. In particular, the work included developing a technique for computing the weight or importance that a pilot assigns to various performance criteria. The work documented here represents the first of a two-phase program. Phase 1 involved developing the basic techniques and methods without collecting extensive pilot data. Phase 2 involves applying the methods to real pilot data collected on the Simulator for Air-to-Air Combat. The approach was based upon a previously developed Adaptive Maneuvering Logic (AML) program. This program operates one-on-one against a real opponent to provide practice in combat flying. It operates by computing a 'score' for each of several alternative next-moves and then executing the move rated highest. The score consists of a sum of weights assigned to each of the various criteria that would be satisfied if the move in question were chosen. The weights are fixed in the AML program. Thus, the program uses a fixed set of weights to produce a simulated performance. GRA

N79-31236# General Electric Co., Daytona Beach, Fla. Ground Systems Dept.
LABORATORY DEVELOPMENT OF COMPUTER GENERATED IMAGE DISPLAYS FOR EVALUATION IN TERRAIN FLIGHT TRAINING Final Report
Roland F. Pester 21 Feb. 1979 22 p refs
(Contract DAHC19-77-C-0006; DA Proj. 2Q7-63743-A-772)
(AD-A070065; ARI-RN-79-8) Avail: NTIS HC A02/MF A01 CSCL 05/9

This report describes the formulation of a digital data base and the equipment utilized to display computer generated images of the resultant terrain scenes. Real time and nonreal time equipment equipment is described. Necessary input data for formulation of digital data bases is delineated. Resulting scene data is to be utilized as stimulus material for evaluation of CGI systems to determine their effectiveness as a medium for training navigators and pilots. Author (GRA)

N79-31237# National Bureau of Standards, Washington, D. C. Fluid Engineering Div.
A LOW-VELOCITY AIRFLOW CALIBRATION AND RESEARCH FACILITY Final Technical Note
L. P. Purtell and F. S. Klebanoff Mar. 1979 26 p refs
(Contract DI-BM-HO-133024)
(PB-294501/2; NBS-TN-989) Avail: NTIS HC A03/MF A01 CSCL 14B

A low velocity airflow facility suitable for the calibration of wind speed measuring instruments and research in aerodynamics is described. The flow facility is of the open return type with a test section 20 feet long, and nominally 3 x 3 feet in cross section. Special attention was given to obtaining an air stream with a high degree of spatial uniformity and low turbulence with excellent speed control over the range from 10 to 3300 feet per minute. Laser-optical methods with appropriate signal processing electronics were employed to establish a primary standard for the measurement of very low velocities. Detailed performance characteristics of flow facility and the laser velocity standard are presented. GRA

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N79-31238# British Aerospace Dynamics Group, Bristol (England). Electronic and Space Systems.
SPACELAB FOLLOW-ON MISSION SUPPORT STUDY. VOLUME 1: SUMMARY Final Report
R. Henderson and A. Vickery Oct. 1978 157 p Prepared in cooperation with Dornier-Werke G.m.b.H., Friedrichshafen, West Germany 6 Vol.
(Contract ESA-3566/78-F-HEW(SC))
(ESS/SS-901-Vol-1; ESA-CR(P)-1183-Vol-1) Avail: NTIS HC A08/MF A01

Engineering support given to ESA in the task of assembling model Spacelab payloads suitable for the demonstration mission is described in a six volume report. Three payload models (with options) were assembled. These include: (1) a microgravity mission for life science radiation experiments, space technology, and for scanning astrophysics experimentation; (2) an earth oriented mission for earth observation and atmospheric physic experimentation; and (3) an astrophysics experimental instrument array. Volume one summarizes the study results for each of the payloads in both engineering and cost sharing indexes terms. Author (ESA)

N79-31239# British Aerospace Dynamics Group, Bristol (England). Electronic and Space Systems.
SPACELAB FOLLOW-ON MISSION SUPPORT STUDY. VOLUME 2: PAYLOAD DM1 Final Report
R. Henderson, J. R. Davis, G. Biddis, P. Gillett, and J. Howard Oct. 1978 140 p Prepared in cooperation with Dornier-Werke G.m.b.H., Friedrichshafen, West Germany 6 Vol.
(Contract ESA-3566/78-F-HEW(SC))
(ESS/SS-901-Vol-2; ESA-CR(P)-1183-Vol-2) Avail: NTIS HC A07/MF A01

Engineering support given to ESA in the task of assembling model Specelab payloads suitable for the demonstration mission series is described in a six volume report. This volume describes a Spacelab mission designed to exploit the low gravity mode of operation in the early European Utilization Program. The prime disciplines to be given a flight opportunity are the material and life sciences. The factor to be exploited is the longer duration available for experimentation. Crystal growth studies as well as crew physiology, sled experiments, biology experiments, particularly plant and animal experiments, will be undertaken. The resources available for such a configuration are summarized and experimental design is discussed in detail. Author (ESA)

N79-31240# British Aerospace Dynamics Group, Bristol (England). Electronic and Space Systems.
SPACELAB FOLLOW-ON MISSION SUPPORT STUDY. VOLUME 3: PAYLOAD DM2 Final Report
E. Achtermann, K. L. Bitzer, W. Gilg, W. Kriegl, O. Neff, R. Nord, W. Trogus, G. Wirths, R. Henderson, and G. Biddis Oct. 1978 131 p Prepared in cooperation with Dornier-Werke G.m.b.H., Friedrichshafen, West Germany 6 Vol.
(Contract ESA-3566/78-F-HEW(SC))
(ESS/SS-901-Vol-3; ESA-CR(P)-1183-Vol-3) Avail: NTIS HC A07/MF A01

Engineering support given to ESA in the task of assembling model Spacelab payloads suitable for the demonstration mission series is described in a six volume report. This volume describes a Spacelab payload composed of 35 experiments for atmospheric, solar, and earth observation investigations. Besides the structural accomodation, the power and energy compatibility with Spacelab is analyzed. The payload in the proposed form seems to be adapted, with several constraints, to the Spacelab capability. Author (ESA)

N79-31241# British Aerospace Dynamics Group, Bristol (England). Electronic and Space Systems.
SPACELAB FOLLOW-ON MISSION SUPPORT STUDY. VOLUME 4: PAYLOAD D4 Final Report
R. Henderson, J. Davis, G. Biddis, P. Gillett, and J. Howard Oct. 1978 150 p Prepared in cooperation with Dornier-Werke

G.m.b.H., Friedrichshafen, West Germany 6 Vol.
(Contract ESA-3566/78-F-HEW(SC))
(ESS/SS-901-Vol-4; ESA-CR(P)-1183-Vol-4) Avail: NTIS HC A07/MF A01

Engineering support given to ESA in the task of assembly model Spacelab payloads suitable for the demonstration mission series is described in a six volume report. This volume describes a Spacelab payload designed for a deep space pointing attitude with several astronomy objectives. Experiments involve infrared astronomy, extreme ultraviolet/ultraviolet astronomy, gamma ray astronomy, cosmic radiation and high energy physics as well as visual astronomy. A long duration mission (10 days) is envisaged. The payload is to cater, for large telescope facilities as a step in the European Astronomy Program (EXOSAT, Space Telescope). Author (ESA)

N79-31242# British Aerospace Dynamics Group, Bristol (England). Electronic and Space Systems.
SPACELAB FOLLOW-ON MISSION SUPPORT STUDY. VOLUME 5: COST INDICES Final Report
A. P. Vickery Oct. 1978 188 p Prepared in cooperation with Dornier-Werke G.m.b.H., Friedrichshafen, West Germany 6 Vol.
(Contract ESA-3566/78-F-HEW(SC))
(ESS/SS-901-Vol-5; ESA-CR(P)-1183-Vol-5) Avail: NTIS HC A09/MF A01

The results and conclusions of the Cost Sharing Indexes (CSI) calculated during the course of the Spacelab follow-on mission support study, for the experiments that were being considered in the study, are presented. Assumptions on module/pallet configuration, number of energy kits, and mission duration had to be made for candidate experiments, calculating the effects on mass, volume, and energy consumption. Demonstration missions one and two are analyzed in detail showing the total national CSI for the payload listed in the included table, in terms of mass, energy and volume. German mission 4 (D4) is also analyzed. Author (ESA)

N79-31243# Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany). Main Dept. for Predevelopment and Studies.
SYSTEM STUDY OF NEAR-TERM SPACELAB FOLLOW ALTERNATIVES. VOLUME 1: TECHNICAL REPORT Final Report
P. Natenbruk, W. Wienss, H. Friedrich, and S. Ransom Dec. 1978 209 p 2 Vol.
(Contract ESA-3565/78-F-HEW(SC))
(PRV-11/78-Vol-1; ESA-CR(P)-1211-Vol-1) Avail: NTIS HC A10/MF A01

Individually defined Spacelab improvements related to the categories of increased electrical power and heat rejection for Spacelab payloads, extended mission durations beyond seven days, and improved operational flexibility and payload services are discussed. Design impact on system level is identified. Combined effects on operation and mission capability are described and implementation alternatives, schedules, and cost projections are established. Author (ESA)

N79-31244# Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany). Main Dept. For Predevelopment and Studies.
SYSTEM STUDY OF NEAR-TERM SPACELAB FOLLOW-ON DEVELOPMENT ALTERNATIVES. VOLUME 2: PROGRAMMATIC CONSIDERATIONS Final Report
P. Natenbruk Dec. 1978 95 p refs 2 Vol.
(Contract ESA-3565/78-F-HEW(SC))
(PRV-11/78-Vol-2; ESA-CR(P)-1211-Vol-2) Avail: NTIS HC A05/MF A01

The programmatic assessment of improvement items including implementation assumptions and alternatives, costing of the improvement items to a total budget necessary for the SL-FOD first step, and a summary of the technical and programmatic results and recommendations for a subsequent effort are presented. Author (ESA)

N79-31245# British Aerospace Dynamics Group, Bristol (England). Electronic and Space Systems.
SPACELAB FOLLOW-ON MISSION SUPPORT STUDY. VOLUME 6: RIDER Final Report
R. Henderson, J. Davis, G. Biddis, P. Gillett, M. Biddell, R. Parker, C. Wheeler, E. Achtermann, R. Nord, and K. L. Bitzer Apr. 1979 418 p Prepared in cooperation with Dornier-Werke G.m.b.H., Friedrichshafen, West Germany
(Contract ESA-3566/78-F-HEW(SC))
(ESS/SS-901-Vol-6; ESA-CR(P)-1183-Vol-6) Avail: NTIS HC A18/MF A01

The Spacelab demonstration mission series was studied and is described in a six volume report. The objective of the study was to provide engineering support to ESA in the task of assembling model Spacelab payloads which might be suitable for the demonstration mission series. Under direction from ESA, three payload models (with options) were assembled. In addition, the Cost Share Index for each experiment included in the options was calculated on the basis of resource ultilization. A rider to the study was undertaken in October 1978 and completed in March 1979 to address specific problems which could not be resolved during the main study analysis; additionally, thermal requirements were addressed. New payload options using different Spacelab configurations were generated. Author (ESA)

N79-31680# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Bereich fuer Projekttraegerschaften.
PROGRAM PLANNING AND PERFORMANCE OF THE SPACELAB UTILIZATION PREPROGRAM TEXUS: TECHNOLOGICAL EXPERIMENTS UNDER ZERO GRAVITY
D. Faust *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 313-315 (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

N79-31682# Royal Inst. of Tech., Stockholm (Sweden).
THE SWEDISH TEXUS EXPERIMENT: A TECHNICAL DESCRIPTION AND SOME PRELIMINARY RESULTS
T. Carlberg, H. Fredriksson, P. Sunnerkranz, S. Grahn (Swed. Space Corp.), and L. Stenmark (Swed. Space Corp.) *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Altitudes Jun. 1978 p 325-338 refs (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

N79-31683# Commissariat a l'Energie Atomique, Grenoble (France).
ON THE USE OF SHORT ZERO GRAVITY PERIODS TO STUDY THE SOLIDIFICATION OF Al-In UNMIXABLE ALLOYS [INTERET DE COURTES PERIODES D'IMPESANTEUR POUR L'ETUDE DE LA SOLIDIFICATION DES ALLIAGES IMMISCIBLES Al-In]
C. Potard *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 339-343 refs In FRENCH (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

N79-31684# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Inst. for Materials Research.
REARRANGEMENT AND SEPARATION PROCESSES DURING LIQUID PHASE SINTERING UNDER MICROGRAVITY CONDITIONS
H. U. Walter and G. Ziegler *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 345-352 refs (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

N79-31703# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
THE SPACE PROCESSING MISSION OF TEXUS 1 WITH RESPECT TO A MICRO-G ENVIRONMENT AND RECOVERY
K. Schmidt, G. Schneiders, G. E. Todd, and G. Schmitt (Kayser Threde GMBH) *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 475-481 refs (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N79-31246*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ORBIT DESIGN FOR SOLAR AND DUAL SATELLITE OCCULTATION MEASUREMENTS OF ATMOSPHERIC CONSTITUENTS
David R. Brooks and Edwin F. Harrison Jul. 1979 56 p refs Presented at the AAS/AIAA Astrodyn. Specialist Conf., Provincetown, Mass., 25-27 Jun. 1979
(NASA-TM-80137; AIAA-Paper-79-101) Avail: NTIS HC A04/MF A01 CSCL 22A

Two types of satellite based occultation missions are considered for measuring atmospheric constituents. Nominal cases for each type are presented to demonstrate representative solutions to orbit design problems. For the solar occultation mode, large areas of the globe can be covered during a one year mission, but the measurements are limited to local dawn or dusk. For the dual satellite mode, with a laser aboard a second satellite to act as a source, diurnal coverage can be obtained at the expense of more complex systems and mission scenarios. In this mode, orbit pairs are selected which maintain their relative orbit plane geometry while their differing periods drive cyclic patterns of latitude coverage. A simulated one year solar occultation mission is used to illustrate one way of analyzing occultation data by averaging measurements within bands of constant latitude. Author

N79-31247*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
THE GEOMETRY OF STELLAR OCCULTATION MEASUREMENTS ON LONG-DURATION ATMOSPHERIC MONITORING MISSIONS
David R. Brooks Jul. 1979 27 p refs
(NASA-TM-80138) Avail: NTIS HC A03/MF A01 CSCL 03A

Geometrical considerations are presented for analyzing use of the stellar occultation technique on long duration earth atmosphere monitoring missions. The simulated mission data are presented for three representative orbits. Bright near infrared stars are used as examples of how extensive global longitude-latitude coverage is obtained by performing occultation measurements on several stars during the course of a one year mission. A comparison is made with similar missions using the sun as a light source. Author

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air)*.

N79-31248# National Aerospace Lab., Amsterdam (Netherlands).
A LOW-COST GROUND STATION FOR RECEPTION AND PREPROCESSING OF REMOTE SENSING SATELLITE DATA
N. J. J. Bunnik, H. A. vanIngenSchenau, C. A. Schmeitink, J. T. Hoeve, G. J. H. Wensink, H. T. Huele, J. A. Wijen, G. T. M. Hermans, and L. S. IJff Dec. 1978 264 p refs Prepared in cooperation with Hollandse Signaalapparaten N. V. Original contains color illustrations
(Contract ESA-3525/78-F-DK(SC))
(NLR-TR-78119-L; ESA-CR(P)-1180) Avail: NTIS HC A12/MF A01

A conceptual design for a low-cost ground station for reception and preprocessing of remote sensing satellite data is described. An assessment was made of key applications and user requirements for a local station situated in a developing country. A survey of existing and planned remote sensing satellites and ground stations is presented. For prospective applications in developing countries and within the low-cost approach, attention is given to reception of the low bit rate LANDSAT-MSS and SPOT-HRV data. Data reduction by means of limitation of the coverage area and selection of useful data, satisfying image quality criteria, is proposed to reduce cost of front-end, preprocessing, archiving and data management. An overall cost reduction of the front-end for the required coverage radius of the station is obtained by application of an antenna with a 4.6 m diameter and a low-noise high-gain pre-amplifier of 60 K and 30 dB for LANDSAT-MSS. Author (ESA)

N79-31249# Thomson-CSF, Meudon-la-Foret (France).
STUDY OF THE DEFINITION OF A GROUND SAR PROCESSOR FOR SEASAT-A Final Report
Heraud, Schang, Anthouard, Carre, Y. Legal (CIMSA), J. C. Gilbert (CIMSA), and Timsit (Adersa Gerbios) 1978 136 p
(Contract ESA-3350/77-NL-HP(SC))
(ESA-CR(P)-1199) Copyright. Avail: NTIS HC A07/MF A01

A ground processor for the SEASAT A - synthetic aperture radar (SAR) is discussed. The solutions retained for the processing as well as the equipment performance specifications are given. Solutions, such as going from a high throughput rate to low throughput rates with intermediate high density data transmission buffering to bring down the input data rate were considered. All solutions are based on the use of parallel one bit processors which form the basic building block of the PROPAL II processor. Such an architecture was demonstrated to be able to adapt to varied processing requirements and, therefore, its flexibility and growth potential is important. The processor configuration retained was optimized for cost at the expense of throughput performance. Author (ESA)

N79-31657# Swedish Space Corp., Kiruna.
ESRANGE FOR SCIENTIFIC RESEARCH USING SOUNDING ROCKETS AND BALLOONS
A. Helger *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 151-160 (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

N79-31658# Royal Norwegian Council for Scientific and Industrial Research, Oslo. Space Activity Div.
RECENT AND FUTURE ACTIVITY AT ANDOYA ROCKRANGE
R. Bjurstroem and A. Gundersen *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 161-166 refs (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

N79-31659# Instituto Nacional de Tecnica Aeroespacial, Madrid (Spain).
THE 'EL ARENOSILLO' SOUNDING ROCKET RANGE
J. Casas and M. Vilches *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 167-172 (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

N79-31660# Campo de Lancamento de Foguetes da Barreira do Inferno, Natal (Brazil).
BARRIERA DO INFERNO: THE BRAZILIAN SOUNDING ROCKET RANGE
F. J. Hennemann *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Altitudes Jun. 1978 p 173-179 (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

N79-31661# Danish Meteorological Inst., Copenhagen.
SOENDRE STROMFJORD ROCKET RANGE
T. Stockflet Joergensen *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 181-183 (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

N79-31662# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
THE MOBILE ROCKET LAUNCHING FACILITY: DEVELOPMENTS AND ACTIVITIES
R. Klein *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 185-187 (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

N79-31663# Centre National d'Etudes Spatiales, Paris (France).
THE GUYANA SPACE CENTER
J. J. Cahen *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 189-194 (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N79-31250*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LAUNCH SUMMARY FOR 1978
Robert W. Vostreys Aug. 1978 42 p refs Revised
(NASA-TM-80503; NSSDC/WDC-A-R/S-79-04) Avail: NTIS HC A03/MF A01 CSCL 22A

Sounding rocket, satellite, and space probe launchings are presented. Time, date, and location of the launches are provided. The sponsoring countries and the institutions responsible for the launch are listed. A.W.H.

N79-31251*# PRC Energy Analysis Co., McLean, Va.
SATELLITE POWER SYSTEM (SPS) RESOURCE REQUIREMENTS (CRITICAL MATERIALS, ENERGY, AND LAND)
Allan D. Kotin (Kotin (Allan D.) Economic Consultants, Los Angeles, Calif.) Oct. 1978 126 p refs Sponsored in cooperation with NASA
(Contract EG-77-C-01-4024)
(NASA-CR-162310; SE-4024-T1) Avail: NTIS HC A07/MF A01 CSCL 10A

The resource impacts of the proposed satellite power system (SPS) were reviewed. Three classes of resource impacts were considered separately: critical materials, energy and land use. The analysis focused on the requirements associated with the annual development of two five-gigawatt satellites and the associated receiving facilities. DOE

N79-31252# Office National d'Etudes et de Recherches Aerospatiales, Leclerc (France). Direction des Etudes de Synthese.
A GENERAL STUDY OF THE INFLUENCE OF ONBOARD LIQUIDS ON SATELLITE BEHAVIOR Final Report [ETUDE GENERALE DE L'INFLUENCE DES LIQUIDES CONTENUS DANS LES SATELLITES]
J. P. Guibert, H. T. Huynh, and J. L. Marce Sep. 1978 413 p refs In FRENCH
(Contract ESTEC-2720/76-NL-AK(SC))
(ONERA-RT-N-1/3307-SY; ESA-CR(P)-1166) Avail: NTIS HC A18/MF A01

Two general problems associated with the stabilization of spacecraft along three axes and relative to the presence of onboard liquids are studied. These are the determination of the localization of liquids in a reduced gravity environment, and the study of the dynamic coupling between the movements of the liquids and those of a satellite. Specific problems concerning the design of storage tanks (presence of a diaphragm) and the particular physical nature of the liquid used (cryogenic liquids) are also treated. Mathematical models for all phenomena discussed are presented. Liquid-vapor interfaces and equilibrium, capillary hysteresis of semiwetting liquids, and dynamic variations in contact angle are emphasized. The need for more powerful computer programs (three dimensional analysis with complex geometries) as well as a program of experimentation onboard Spacelab is noted. Author (ESA)

N79-31253# British Aerospace Dynamics Group, Bristol (England). Electronics and Space Systems.
INVESTIGATION OF THE APPLICATION OF THE BAC COUNTERSPIN NUTATION DAMPER FOR ESA SATELLITES Final Report
J. Simpson and R. Arnett Oct. 1977 73 p
(Contract ESA-2941/76-NL-AK(SC))
(ESS/SS-837; ESA-CR(P)-1187) Avail: NTIS HC A04/MF A01

A theoretical analysis of damper performance is presented, showing the necessity for counterspinning the wheel. The existance of an optimum viscosity value when no spring enhancement is present, the existance of an optimum value for the spring constant when spring enhancement is present, the fact that the damper time constant can be made arbitrarily close to zero, and the Coulomb friction torques produced by residual undampable mutation are also shown. A detailed analog computer simulation was made which agrees with the optimum coefficients of spring and viscous torque. The application of the damper to a variety of spacecraft is considered, with emphasis on the system aspects of the implementation. Author (ESA)

N79-31254# National Aerospace Lab., Amsterdam (Netherlands). Div. of Scientific Services.
PROCESSING OF METEOSAT ATTITUDE MEASUREMENT FLIGHT DATA AND EVALUATION OF THE PERFORMANCE OF AN ADAPTIVE FILTERING TECHNIQUE
C. R. Traas and G. Moek 1978 68 p refs
(Contract ESTEC-3319/77)
(NLR-TR-78146-U; ESA-CR(P)-1218) Avail: NTIS HC A04/MF A01

The attitude measurement data of the ESA geosynchronous spacecraft METEOSAT were analyzed using an adaptive recursive filtering technique. The mathematical models of spacecraft dynamics and sensors were kept very simple. Modeling errors are such that, without adaptive feedback, strong divergence of the filtering process occurs. Is is shown that the adaptive process stabilizes the filtering considerably. Complete error consistency, however, could not be attained in the present case. The reasons for this are analyzed. Author (ESA)

N79-31663# Swedish Space Corp., Solna.
THE NIKE-ORION SUCCESSFULLY INTRODUCED AT ESRANGE
P. Zetterquist *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 119-120 (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

N79-31679# Bundesministerium fuer Forschung und Technologie, Bonn (West Germany).
MATERIALS SCIENCE REVIEW
G. Greger *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Altitudes Jun. 1978 p 307-312 (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

N79-31681# Kayser Threde G.m.b.H., Munich (West Germany).
THE CONCEPT OF A MODULAR PAYLOAD WITH DECENTRALIZED INSTRUMENTATION
A. Schmalz and G. Schmitt *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 317-321 (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

N79-31686# Kayser Threde G.m.b.H., Munich (West Germany).
ADAPTATION OF SOUNDING ROCKET TECHNOLOGY TO SPACELAB SUBSATELLITES
R. Klett and A. Schmalz *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 365-374 refs Sponsored by ESA (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

N79-31693# Bristol Aerojet, Ltd., Banwell (England).
SMALL ROCKETS FOR EXPERIMENTS AT HIGH LEVELS
W. T. Fisher *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 407-409 (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

N79-31694# British Aerospace Dynamics Group, Bristol (England).
RECENT ADVANCES IN SKYLARK VEHICLE TECHNOLOGY
D. J. Brown *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 411-416 refs (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

N79-31696# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. for Flight Systems Dynamics.
FAST PRE-LAUNCH TARGETING AND COMPUTATIONS FOR CONTROLLED SOUNDING ROCKETS
A. E. Pietrass and L. H. Larsson (Swed. Space Corp.) *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 423-430 refs (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

N79-31698# Swedish Space Corp., Solna.
THE S19 GUIDANCE SYSTEM FOR REDUCTION OF SOUNDING ROCKET DISPERSION
L. Anderson, S. Lundin, and J. Andersson (Saab-Scania AB) *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 437-440 refs (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

N79-31699# Saab-Scania, Linkoping (Sweden).
SOME SUBSYSTEMS OF PAYLOAD S29
J. Andersson and T. Forsell *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 441-447 (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

N79-31700# Space Vector Corp., Northridge, Calif.
SOUNDING ROCKET ATTITUDE CONTROL UTILIZING TUNED ROTOR GYROS
R. O. Rasmussen, S. D. Lyon, and J. H. Jerger *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 449-456 ref (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

N79-31704# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
AN ATTITUDE SENSING TECHNIQUE FOR SOUNDING ROCKETS, USING RF-INTERFEROMETRY
G. Mayer and G. E. Todd *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 483-486 refs (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation.*

N79-31255*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
FLIGHT DESIGN SYSTEM LEVEL C REQUIREMENTS. SOLID ROCKET BOOSTER AND EXTERNAL TANK IMPACT PREDICTION PROCESSORS
R. H. Seale (McDonnell Douglas Technical Services Co.) Aug. 1979 165 p refs
(NASA-TM-80520; JSC-16072; Rept-79-FM-29) Avail: NTIS HC A08/MF A01 CSCL 22B

The prediction of the SRB and ET impact areas requires six separate processors. The SRB impact prediction processor computes the impact areas and related trajectory data for each SRB element. Output from this processor is stored on a secure file accessible by the SRB impact plot processor which generates the required plots. Similarly the ET RTLS impact prediction processor and the ET RTLS impact plot processor generates the ET impact footprints for return-to-launch-site (RTLS) profiles. The ET nominal/AOA/ATO impact prediction processor and the ET nominal/AOA/ATO impact plot processor generate the ET impact footprints for non-RTLS profiles. The SRB and ET impact processors compute the size and shape of the impact footprints by tabular lookup in a stored footprint dispersion data base. The location of each footprint is determined by simulating a reference trajectory and computing the reference impact point location. To insure consistency among all flight design system (FDS) users, much input required by these processors will be obtained from the FDS master data base. A.R.H.

N79-31256# Committee on Science and Technology (U. S. House).
OVERSIGHT: SPACE SHUTTLE PROGRAM COST, PERFORMANCE, AND SCHEDULE REVIEW
Daniel E. Cassidy, Gerald E. Jenks, Thomas N. Tate, and Darrell R. Branscome Washington GPO 1979 84 p refs Rept. for the Subcomm. on Space Sci. and Applications of the Comm. on Sci. and Technol., 96th Congr., 1st Sess., Aug. 1979
(GPO-49-320) Avail: Subcomm. on Space Sci. and Applications

Testimony submitted by witnesses in response to Subcommittee reservations regarding the adequacy of the NASA funding request for fiscal year 1980 is summarized. The status of the space shuttle program is reviewed and a number of major issues are discussed. Recommendations for improving budget requirement estimating as well as program cost and schedule control are included. A.R.H.

N79-31257*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
OPTIMUM REPAIR LEVEL ANALYSIS (ORLA) FOR THE SPACE TRANSPORTATION SYSTEM (STS)
W. R. Henry Jul. 1979 28 p
(NASA-TM-78239) Avail: NTIS HC A03/MF A01 CSCL 22B

A repair level analysis method applied to a space shuttle scenario is presented. A determination of the most cost effective level of repair for reparable hardware, the location for the repair, and a system which will accrue minimum total support costs within operational and technical constraints over the system design are defined. The method includes cost equations for comparison of selected costs to completion for assumed repair alternates. A.W.H.

N79-31258# ARO, Inc., Arnold Air Force Station, Tenn.
DATA VERIFICATION TESTS OF A 0.02-SCALE NASA SPACE SHUTTLE LAUNCH VEHICLE AT MACH NUMBERS FROM 0.60 TO 1.55 Final Report
J. A. Black AEDC 5 Feb. 1979 49 p refs Sponsored by the Air Force
(AD-A069194; AEDC-TSR-79-P7) Avail: NTIS HC A03/MF A01 CSCL 22/2

A 0.02-scale model of the NASA Space Shuttle Integrated Launch Vehicle was tested November 15 and 16, 1978 in the Propulsion Wind Tunnel (16T) at free-stream Mach numbers from 0.60 to 1.55, free-stream dynamic pressures from 388 to 658 psf, angles of attack from -8 to 8 deg, angles of sideslip from -6 to 6 deg, and roll angles of 0, 180, -90, and 90 deg with nominal inboard elevon deflections of 10 deg and outboard elevon deflections of 5 deg. The objectives of the test were to determine applicable angular corrections in the pitch and sideslip planes and to establish, throughout an alpha/beta matrix, a data base for the determination of angular corrections to be applied to previously obtained data. GRA

N79-31259# ARO, Inc., Arnold Air Force Station, Tenn.
AEROTHERMAL EVALUATION OF THE SPACE SHUTTLE SOLID ROCKET BOOSTER AND SOLID ROCKET MOTOR THERMAL PROTECTION SYSTEM Final Report, Dec. 1977 - Jan. 1979
John O. Ievalts and Robert L. Spinetti AEDC Mar. 1979 63 p refs
(AD-A070444; AEDC-TSR-79-V12) Avail: NTIS HC A04/MF A01 CSCL 22/2

Samples of insulation materials under consideration for use on the various protuberances of the Space Shuttle Solid Rocket Boosters and Solid Rocket Motors were tested to evaluate their survivability at simulated flight heating levels. Heat transfer calibration data were obtained by use of the thin-skin technique on several protuberance configurations. All tests were conducted in the VKF tunnel. GRA

N79-31260# British Aerospace Dynamics (Space), Stevenage (England).
PHASE TWO: STUDY ON SMALL EXPERIMENT MOUNT (SEM). VOLUME 1: TECHNICAL DETAILS Final Report
C. Collins Nov. 1978 362 p
(Contract ESA-3477/78)
(TP-7714; ESA-CR(P)-1181) Copyright. Avail: NTIS HC A16/MF A01

The design of a small experiment mount (SEM) to be used in Spacelab was studied. The conceptual design analysis, analysis of payload/SEM operations, analysis and budgetary estimate of SEM operating costs, analysis and budgeting of the development program, and the preparation of technical specifications and a performance test plan are presented. Besides the theoretical considerations necessary for system modeling, the hardware envisaged as part of or auxiliary to the SEM is discussed in detail. Author (ESA)

N79-31261# British Aerospace Dynamics Group, Bristol (England). Electronic and Space Systems.
A FOLLOW-ON STUDY OF A SPIN-UP AND EJECTION MECHANISM (SUEM). VOLUME 1: REPORT SUMMARY Final Report
E. Crellin, M. Humphries, C. S. Rostron, and E. P. L. Windsor Jul. 1978 73 p 2 Vol.
(Contract ESA-3487/78-F-DK(SC))
(ESS/SS-910-Vol-1; ESA-CR(P)-1200-Vol-1) Avail: NTIS HC A04/MF A01

The work carried out during a follow-on study of a spin-up and ejection mechanism (SUEM) for Spacelab is described. The current study was aimed at achieving better low ejection velocity characteristics at the expense of the high velocity part of the spectrum and a reduction of development cost. This is achieved by the adoption of a spring actuation system which is combined with a redesigned clamp/release mechanism. A summary of the complete study is presented including development and cost aspects. Author (ESA)

N79-31262# British Aerospace Dynamics Group, Bristol (England). Electronic and Space Systems.
A FOLLOW-ON STUDY OF A SPIN-UP AND EJECTION MECHANISM (SUEM). VOLUME 2: STUDY NOTES Final Report
E. Crellin, M. Humphries, C. S. Rostron, and E. P. L. Windsor Jul. 1978 150 p ref 2 Vol.
(Contract ESA-3487/78-F-DK(SC))
(ESS/SS-910-Vol-2; ESA-CR(P)-1200-Vol-2) Avail: NTIS HC A07/MF A01

The ejection dynamics of SUEM are analyzed and a computer simulation is developed. The simulation is used to update the performance envelope of the ejection mechanism and to investigate the extension of the envelope down to an ejection velocity of 1/3 1/ms for a 50kg satellite. Author (ESA)

N79-31263# Engins Matra, Velizy (France).
STUDY ON EVOLUTION OF COMMAND AND DATA MANAGEMENT ON SPACELAB (DCMS) Final Report
P. Jourdan, J. P. Ruffie, M. Turin, J. Valero, and P. Pitard Nov. 1978 183 p
(Contract ESA-3520/78-NL-JS)
(TN-MA-158; ESA-CR(P)-1227) Avail: NTIS HC A09/MF A01

The evolution of command and data management systems (CDMS) on Spacelab was studied not to redesign the CDMS but mainly to improve it by specific modifications which fall into five improvement categories. Results are, by category: (1) an extension of the memory to 128 words to increase operational flexibility; (2) the implementation of a magnetic bubble memory of a disk to augment CDMS versatility; (3) the rejection of a space hardening of CDMS equipment scheme due to difficulties with component changes and mechanical redesign; (4) a significant power reduction with existing CDMS equipment; and (5) a mission duration extension up to 30 days involving only minor CDMS modification. The CDMS impact on ground support systems is also reviewed. Author (ESA)

N79-31685# British Aerospace Dynamics Group, Bristol (England).
GENERAL PURPOSE SPACELAB SUBSATELLITE BUS BASED ON SOUNDING ROCKET TECHNOLOGY
D. M. Ashford *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 357-364 refs (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

N79-31264*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LIFE CHARACTERISTICS ASSESSMENT OF THE COMMUNICATIONS TECHNOLOGY SATELLITE TRANSMITTER EXPERIMENT PACKAGE
Jerry Smetana and Arthur N. Curren Jul. 1979 52 p refs
(NASA-TM-79181; E-049) Avail: NTIS HC A04/MF A01 CSCL 17B

The performance characteristics of the transmitter experiment package (TEP) aboard the Communications Technology Satellite (CTS) measured during its first 2 years in orbit are presented. The TEP consists of a nominal 200 watt output stage tube (OST), a supporting power processing system (PPS), and a variable conductance heat pipe system (VCHPS). The OST, a traveling wave tube augmented with a 10 stage depressed collector has an overall saturated average efficiency of 51.5 percent and an average saturated radio frequency (rf) output power at center band frequency of 240 watts. The PPS operated with a measured efficiency of 86.5 to 88.5 percent. The VCHPS, using three pipes to conduct heat from the PPS and the OST to a 52 by 124 centimeter radiator fin, maintained the PPS baseplate temperature below 50 C for all operating conditions. The TEP performance characteristics presented include frequency response, rf output power, thermal performance, and efficiency. Communications characteristics were evaluated by using both video and audio modulated signals. On four occasions, the TEP experienced temporary thermal control system malfunctions. The anomalies were terminated safely, and the problem was investigated because of the potential for TEP damage due to the signficant temperature increases. Safe TEP operating procedures were established. K.L.

N79-31697# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
EVALUATION OF TELEMETRY DATA FOR POST-FLIGHT ATTITUDE DETERMINATION OF SOUNDING ROCKETS
J. Stangl (Industrieanlagen Betriebsgesellschaft), R. Thiemann (Industrieanlagen Betriebsgesellschaft), and N. Jansen *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 431-436

refs (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N79-31265*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NASCAP MODELLING OF ENVIRONMENTAL-CHARGING-INDUCED DISCHARGES IN SATELLITES
N. John Stevens and James C. Roche 1979 25 p refs Presented at Ann. Conf. on Nucl. and Space Radiation Effects, Santa Cruz, Calif. 17-20 Jul. 1979; sponsored by IEEE
(NASA-TM-79247; E-155) Avail: NTIS HC A02/MF A01 CSCL 22B

The charging and discharging characteristics of a typical geosynchronous satellite experiencing time-varying geomagnetic substorms, in sunlight, were studied utilizing the NASA Charging Analyzer Program (NASCAP). An electric field criteria of 150,000 volts/cm to initiate discharges and transfer of 67 percent of the stored charge was used based on ground test results. The substorm characteristics were arbitrarily chosen to evaluate effects of electron temperature and particle density (which is equivalent to current density). It was found that while there is a minimum electron temperature for discharges to occur, the rate of discharges is dependent on particle density and duration times of the encounter. Hence, it is important to define the temporal variations in the substorm environments. J.M.S.

N79-31266# European Space Agency, Paris (France).
SPACECRAFT THERMAL AND ENVIRONMENTAL CONTROL SYSTEMS
M. Khine, ed and B. Battrick, ed Oct. 1978 645 p refs Proc. of ESA Intern. Symp., Munich, 10-12 Oct. 1978
(ESA-SP-139) Avail: NTIS HC A99/MF A01

Progress in the field of spacecraft thermal and environmental control was reviewed. Main subjects are satellite thermal control design, heat pipe technology, manned spacecraft thermal system design, methods and techniques of analysis, manned spacecraft thermal system analysis approach, thermal effects on structures, fluid loop components, noise control, insulation, test and verification aspects, active thermal control systems, experiment thermal control, cryogenic systems, spacecraft thermal system accommodation for payloads, and future trends, requirements, and guidelines. For individual titles, see N79-31267 through N79-31336.

N79-31267# Aeritalia S.p.A., Torino (Italy).
THERMAL DESIGN OF SIRIO SATELLITE
B. Strim and G. Pellis *In* ESA Spacecraft Thermal and Environ. Control Systems Oct. 1978 p 3-8 (For primary document see N79-31266 22-18)
Avail: NTIS HC A99/MF A01

The SIRIO (Satellite Italiano per la Ricerca Operativa) satellite is a spin stabilized geostationary satellite developed to explore the propagation of ratio frequencies in the 12 to 18 GHz range. The thermal control as developed both at software and hardware levels is described. The thermal analysis was performed with reduced mathematical models for the overall satellite and with detailed ones for subsystems or equipment. The thermal design combines passive and semi-active conventional techniques. The performance of the thermal control was verified by means of solar simulation tests and successfully confirmed by the satellite thermal flight behavior. Major problem areas encountered during subsystem design/development are discussed. Author (ESA)

N79-31268# Compagnia Nazionale Aerospaziale S.p.A., Rome (Italy).
SIRIO THERMAL CONTROL FROM A SYSTEM STANDPOINT
L. Forastieri *In* ESA Spacecraft Thermal and Environ. Control Systems Oct. 1978 p 9-17 refs (For primary document see N79-31266 22-18)
Avail: NTIS HC A99/MF A01

A general survey of main thermal control research activities during the SIRIO program is presented emphasizing system design and verification criteria. Flight temperatures, covering one year in geosynchronous orbit, are then presented and compared with design limits, test results, and predictions. Results compare favorably with system specifications. Author (ESA)

N79-31269# Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost.
EXPERIENCES RELATED TO GEOS THERMAL CONTROL
N. J. vandeBraak *In* ESA Spacecraft Thermal and Environ. Control Systems Oct. 1978 p 19-25 refs (For primary document see N79-31266 22-18)
Avail: NTIS HC A99/MF A01

The thermal control subsystem of the European scientific satellite GEOS is described. Experience obtained during design, development, and hardware assembly is reviewed. Special attention is paid to electrical conductivity and grounding of thermal control materials. Further specific problem areas related to appendages, the apogee boost motor, and the reaction control equipment are examined. Author (ESA)

N79-31270# Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany).
ORBITAL TEST SATELLITE (OTS) THERMAL DESIGN AND IN-ORBIT PERFORMANCE
D. Stuempel *In* ESA Spacecraft Thermal and Environ. Control Systems Oct. 1978 p 27-34 refs (For primary document see N79-31266 22-18)
Avail: NTIS HC A99/MF A01

The major constraints put on the OTS thermal subsystem are reviewed and the essential steps of the development and test phases along with the final thermal layout summarized. Some emphasis is put on critical problems, their resolution and the consequences for follow-on projects. The subsystem in-orbit performance is briefly demonstrated and discussed vis a vis relevant American achievements. Author (ESA)

N79-31271# European Space Research and Technology Center, Noordwijk (Netherlands).
ORBITAL ASSESSMENT OF OTS THERMAL PERFORMANCE
J.-P. Bouchez, D. H. Howle, and D. Stuempel (Erno Raumfahrttech.) *In* ESA Spacecraft Thermal and Environ. Control Systems Oct. 1978 p 35-45 refs (For primary document see N79-31266 22-18)
Avail: NTIS HC A99/MF A01

Thermally, the Orbital Test Program tasks are to evaluate the performance of the thermal control subsystem at regular intervals during satellite lifetime, to assess any degradation with time of the thermal coatings employed, and to assess the accuracy and adequacy of the mathematical thermal model. Subsidiary goals include assessment of the thermal distortion on the large dish antenna performance. The performance of the thermal sub-system to date is briefly assessed, and in-orbit temperatures obtained at the first solstice and first equinox conditions are compared with the corresponding predictions. The differences between flight and predicted temperatures are demonstrated graphically using histograms. Author (ESA)

N79-31272# ISRO Satellite Centre, Peenya, Bangalore (India).
OBSERVATIONS MADE DURING THE DEVELOPMENT OF A THERMAL CONTROL SYSTEM FOR A NEAR EARTH ORBITING SATELLITE
H. N. Murthy, D. R. Bhandari, and V. Prasad *In* ESA Spacecraft Thermal and Environ. Control Systems Oct. 1978 p 47-51 refs (For primary document see N79-31266 22-18)
Avail: NTIS HC A99/MF A01

The experience gained during the development of a passive thermal control system for the near earth orbiting spacecraft 'Aryabhata' shows that the system cost could be brought down by minimizing the fabrication complexities and the thermal balance

tests. Analysis carried out show that the reduced conduction exchange between top and bottom shells of the spacecraft due to the change in fabrication procedures would not affect the temperature distribution appreciably. The results of thermal balance test conducted on a 0.4 size scale model yield satisfactory results. The inflight temperature data received at the ground station shows good agreement with the predicted temperatures.
Author (ESA)

N79-31273# Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost.
THERMAL DESIGN AND ANALYSIS AS APPLIED IN THE ISEE-B PROGRAM
H. Petersen *In* ESA Spacecraft Thermal and Environ. Control Systems Oct. 1978 p 53-58 (For primary document see N79-31266 22-18)
Avail: NTIS HC A99/MF A01

Possible grounds for the successful development of the thermal control subsystem of the ISEE-B satellite, the first of a new generation low-cost program are evaluated. Major development aspects are highlighted and extensive attention is paid to the application of a guaranteed temperature limits philosophy for which a conscientious strategy for design margins is outlined. The organization around the set-up of a comprehensive mathematical model is discussed and the determination of one of the most critical conduction terms in this model is shown.
Author (ESA)

N79-31274# Stuttgart Univ. (West Germany). Inst. fuer Kernenergetik und Energiesysteme.
HEAT PIPE TECHNOLOGY FOR SPACECRAFT THERMAL CONTROL
M. Groll *In* ESA Spacecraft Thermal and Environ. Control Systems Oct. 1978 p 61-70 refs (For primary document see N79-31266 22-18)
Avail: NTIS HC A99/MF A01

Heat pipe design concepts, materials, and temperature ranges of operation are surveyed. Characteristics of capillary structures and of heat pipe performance are discussed. Variable conductance and thermal diode techniques are discussed and their performance characteristics are presented. The state-of-the-art of heat pipe technology for spacecraft temperature control is reviewed and examples of satellite applications are presented. In addition, the spin-off of this space technology with respect to terrestrial applications is discussed and respective examples are presented.
Author (ESA)

N79-31275# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
DEVELOPMENT OF A HEAT PIPE COOLED 200 WATT TWT WITH IMPROVED EFFICIENCY
H. Kreeb and P. Pawlowski *In* ESA Spacecraft Thermal and Environ. Control Systems Oct. 1978 p 71-72 (For primary document see N79-31266 22-18)
Avail: NTIS HC A99/MF A01

The self-radiating collector of a 200 W, 12 GHz TWT is replaced by a heat pipe cooling system. The outer diameter of the collector, including the heat pipe cooling system is limited to 40 mm, small enough for focusing of the electron beam by magnetic rings. The TWT with a magnetically focused collector (3 stages) will improve the overall efficiency to about 44%. The other parts of the TWT will be cooled by a separate heat pipe system including a gas-controlled heat pipe radiator. A test of the whole system is planned for one of the first missions.
Author (ESA)

N79-31276# Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany).
A HEAT PIPE RADIATOR FOR SHUNT ELECTRONICS: DEVELOPMENT AND TEST RESULTS
R. Schlitt *In* ESA Spacecraft Thermal and Environ. Control Systems Oct. 1978 P 73-83 refs Sponsored by Bundesmin. fuer Forsch. und Technol. (For primary document see N79-31266 22-18)
Avail: NTIS HC A99/MF A01

The design fabrication, and test of a 350 mm x 1600 mm heat pipe radiator to cool large dissipation shunt electronics are described. A configuration with six parallel heat pipes held between layers of a honeycomb sandwich was selected using ammonia as the working fluid. Special attention was given to the interface with the power transistor. Tests were carried out in a liquid nitrogen shrouded vacuum chamber to simulate deep space environment. Test results correlate very well with calculated temperatures.
Author (ESA)

N79-31277# Centre National d'Etudes Spatiales, Toulouse (France).
LONG DURATION TESTS ON VARIABLE CONDUCTANCE HEAT PIPES [ESSAIS DE LONGUE DUREE SUR LES CALODUCS A CONDUCTANCE VARIABLE]
I. Alet *In* ESA Spacecraft Thermal and Environ. Control Systems Oct. 1978 p 85-90 In FRENCH (For primary document see N79-31266 22-18)
Avail: NTIS HC A99/MF A01

Aging and degradation of variable conductance heat pipes were studied. Aging is characterized by variations of heat transfer capacity in the horizontal position and by the formation of noncondensable gases. The experimental test conditions (temperature and heat flow) and the methods utilized to measure the noncondensable gases are described. It is concluded after a 13 month test period that the proposed methods are adequate for measuring aging and gas formation in heat pipes.
Author (ESA)

N79-31278# Societe Nationale Industrielle Aerospatiale, Cannes (France).
HEAT PIPES IN THE THERMAL CONTROL OF COMMUNICATION SATELLITES OF THE FORTHCOMING GENERATION (H-SAT)
B. Moschetti *In* ESA Spacecraft Thermal and Environ. Control Systems Oct. 1978 p 91-97 refs (For primary document see N79-31266 22-18)
Avail: NTIS HC A99/MF A01

Performance of a telecommunications panel with variable conductance heat pipe (VCHP) regulation, and of an experimental radiator module with extruded constant conductance heat pipe (CCHP) regulation are described. The VCHP regulated panel, already presented at the International Heat Pipe Conference in 1976, successfully passed all thermal tests scheduled until September 1976, the results of which are given. In December 1977, the panel was once more tested in thermal vacuum and the original thermal performance data recorded 14 months earlier was verified. This prototype is currently undergoing the endurance qualification test scheduled for a period exceeding 7 years. The CCHP equipped radiator module involves a special mounting technique which combines a carrier honeycomb sandwich structure and two crossed networks of heat pipes. The radiator has also passed thermal vacuum tests with quite satisfactory results as to the performance.
Author (ESA)

N79-31279# Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany).
SPACELAB ENVIRONMENTAL CONTROL SYSTEM DEVELOPMENT AS DEMONSTRATED IN IN-FLIGHT CONFIGURATION
J. Becker *In* ESA Spacecraft Thermal and Environ. Control Systems Oct. 1978 p 101-107 refs (For primary document see N79-31266 22-18)
Avail: NTIS HC A99/MF A01

After a short description of the Spacelab Environmental Control System (ECS) design the major development and improvements since the beginning of the project are described. These changes are mainly in the area of improved capabilities for payloads and design simplifications. They have influenced all major areas of the ECS design but did not lead to a change in the ECS concept.
Author (ESA)

N79-31280# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
THE SPACELAB CABIN LOOP
H. Preiss and A. C. Padwater (Hamilton Std.) *In* ESA Spacecraft Thermal and Environ. Control Systems Oct. 1978 p 109-117 (For primary document see N79-31266 22-18)
(Contract ERNO-CC-DS-000-1-00)
Avail: NTIS HC A99/MF A01

The individual assemblies used to properly fulfill the require-

ments imposed upon the Cabin Loop are described. Within the Environmental Control and Life Support System, the Air Revitalization Section, consisting of two air loops, provides conditioning of Spacelab atmosphere with respect to crew safety, comfort, and equipment cooling. The Cabin Loop includes control of air temperature, humidity, odor, trace contaminants and carbon dioxide, generation of appropriate air flow pattern, filtration of air, and suppression of generated or induced noise. Furthermore, detection of fire and smoke as well as fire suppression are covered. Author (ESA)

N79-31281# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).

THE SPACELAB ATMOSPHERE STORAGE AND CONTROL SECTON (ASCS)

P. Lautenbach and H. G. Toews *In* ESA Spacecraft Thermal and Environ. Control Systems Oct. 1978 p 119-126 (For primary document see N79-31266 22-18)

(Contract ERNO-CC-DS-000-1-00)

Avail: NTIS HC A99/MF A01

The Spacelab Atmosphere Storage and Control Section (ASCS) is described. ASCS furnishes a two-gas earth-like environment in the Spacelab cabin which is compatible with the atmosphere of the orbiter crew compartment. All the equipment to supply and control the Spacelab atmosphere is described. Answers on how the specified system requirements are being met are also provided. Specific design details of ASCS key components are given. Author (ESA)

N79-31282# Aeritalia S.p.A., Torino (Italy).

DEVELOPMENT OF SPACELAB THERMAL CONTROL SYSTEM

P. L. DegliEsposti and E. Vallerani *In* ESA Spacecraft Thermal and Environ. Control Systems Oct. 1978 p 127-138 (For primary document see N79-31266 22-18)

Avail: NTIS HC A99/MF A01

An overview of the activities performed within the framework of Spacelab thermal control system design, development, and production is presented. Thermal control system analysis and design activities started in mid-1974. Development testing at component/subassembly level was completed in 1976. Qualification testing will be completed by the end of 1978. Flight hardware is being manufactured and delivery is planned for 1978. The first flight on board of the shuttle orbiter is scheduled for 1981. Author (ESA)

N79-31283# Rockwell International Corp., Downey, Calif.

ORBITER ENVIRONMENTAL CONTROL AND LIFE SUPPORT SYSTEM

J. W. Gibb *In* ESA Spacecraft Thermal and Environ. Control Systems Oct. 1978 p 139-146 (For primary document see N79-31266 22-18)

Avail: NTIS HC A99/MF A01

The various space shuttle subsystems, their functions, and their requirements are described. The overall system arrangements, including subsystem interfaces and integration with the vehicle and payloads, are discussed as are system performance capabilities. Growth to satisfy increased requirements, and recommendations for future programs are described. Author (ESA)

N79-31284*# Rockwell International Corp., Downey, Calif.

ORBITER THERMAL CONTROL SUBSYSTEM DEVELOPMENT

G. E. Laubach *In* ESA Spacecraft Thermal and Environ. Control Systems Oct. 1978 p 147-154 (For primary document see N79-31266 22-18)

(Contract NAS9-14000)

Avail: NTIS HC A99/MF A01 CSCL 22B

Selected major hardware components and subsystems of the shuttle orbiter are described. These include the hardware configurations, development problems and solutions, performance requirements and attainment, major hardware fabrication problems and solutions, development test objectives and implementation, and utilization of test results for hardware refinements. The subsystems selected for discussion are the space radiator, the ammonia boiler, the flash evaporator, and avionics cold plates. Author (ESA)

N79-31285# Centre National d'Etudes Spatiales, Toulouse (France).

THE CALCULATION OF RADIANT HEAT EXCHANGE COEFFICIENTS ('CALMAR' PROGRAM) BY A RANDOM METHOD [CALCUL DES COEFFICIENTS D'ECHANGES RADIATIFS PAR UNE METHODE ALEATOIRE (PROGRAMME 'CALMAR')]

A. M. Pouzet *In* ESA Spacecraft Thermal and Environ. Control Systems Oct. 1978 p 157-166 refs In FRENCH (For primary document see N79-31266 22-18)

Avail: NTIS HC A99/MF A01

The program CALMAR (radiancy calculation by a random method) is described. This program is used to compute directly the radiation coupling at the inside of a closed irregular cavity where the walls can be reflective or dispersive. The general factors B sub ij, or Gebhart factors that constitute the terms of a results matrix, can be associated to the pseudoradiancies R sub ij by the relationship R sub ij = B sub ij E sub i S sub i, calling E sub i and S sub i the emissivity and the surface of the elemental emitting area respectively. The program can be adapted to calculate the absorption of an external flow by an open cavity. Some examples and computing times required on a CDC 7600 computer are given. Author (ESA)

N79-31286# Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost.

HAND CALCULATION METHODS FOR THERMAL NETWORKS

J. G. W. vanKampen *In* ESA Spacecraft Thermal and Environ. Control Systems Oct. 1978 p 167-173s (For primary document see N79-31266 22-18)

Avail: NTIS HC A99/MF A01

Hand calculation methods which can be used for initial design analyses and comprehensive model checking are described. The methods apply to steady state conditions. Use is made of the existing analogy between thermal and electric networks. Better insight into the temperature performance and heat flows is also provided. Author (ESA)

N79-31287# Mitsubishi Electric Mfg. Co. Ltd., Amagasaki (Japan).

A THERMAL NETWORK CORRECTION SYSTEM FOR SPACECRAFT

S. Shimoji and M. Minowa (Natl. Space Develop. Agency) *In* ESA Spacecraft Thermal and Environ. Control Systems Oct. 1978 p 175-184 refs (For primary document see N79-31266 22-18)

Avail: NTIS HC A99/MF A01

Several computer programs for thermal analysis, statistical analysis, and for temperature simulation are presented. The method used in the statistical analysis is developed on the basis of stepwise multiple regression analysis. It is capable of choosing statistically important parameters in a thermal network model by F-tests and can give their estimated values, which minimize the residuals of heat balance at each mode. The temperature simulation program makes the network model complete and can be space proven by comparing and fitting the predicted temperature with flight data. The system is successfully applied to the development of the Japanese Ionosphere Sounding Satellite. The method of correction and the features of the mathematical process are presented with emphasis on the results of this application. Author (ESA)

N79-31288# Tokyo Univ. (Japan). Inst. of Space and Aeronautical Science.

A THERMAL NETWORK CORRECTION METHOD AND ITS APPLICATION TO SOME JAPANESE SATELLITES

K. Oshima and Y. Kuriyama *In* ESA Spacecraft Thermal and Environ. Control Systems Oct. 1978 p 185-190 refs (For primary document see N79-31266 22-18)

Avail: NTIS HC A99/MF A01

Based on the least square residual method of the thermal balance equations on the network nodal points and using the regression procedure for the resultant normal equation, a network correction method was developed and applied to some Japanese satellites. The resultant thermal network parameters were used to predict the temperature of the simulation test, and the temperature error was analyzed based on statistical analysis.

The best mathematical model of the system tends to be the one with white Gaussian error of the predicted temperature. Finally, the optimizing procedure of the thermal design of a satellite was introduced based on the sensitivity analysis of the thermal modal parameters and the Monte Carlo trial of the maximum rate of descent for the design temperature.
Author (ESA)

N79-31289# European Space Research and Technology Center, Noordwijk (Netherlands).
OPTIMIZATION OF THE MAROTS MATHEMATICAL MODEL USING SOLAR SIMULATION TEST RESULTS AND ESATEST SOFTWARE
B. Pieper and J.-P. Bouchez *In* ESA Spacecraft Thermal and Environ. Control Systems Oct. 1978 p 191-198 refs (For primary document see N79-31266 22-18)
Avail: NTIS HC A99/MF A01

Practical experience in applying ESATEST within the framework of the optimization of the MAROTS 277 node mathematical model for solar simulation tests is reported. The final results of this optimization are presented and compared with those obtained for the thermal control of MAROTS. Author (ESA)

N79-31290# Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany).
ASPECTS OF DEVELOPMENT AND PERFORMANCE OF AN INTEGRATED THERMAL MATH MODEL OF SPACELAB
H. Hafkemeyer *In* ESA Spacecraft Thermal and Environ. Control Systems Dec. 1978 p 201-211 refs (For primary document see N79-31266 22-18)
Avail: NTIS HC A99/MF A01

The development and performance of an integrated thermal math model for the Spacelab configuration of Module plus Pallets is presented. The model is a multinode to be run with the SINDA system with built-in FORTRAN logic for variation of time or temperature dependent system parameters. The results of the calculations are processed with special output formats simplifying their visibility and documentation. The size of the model is limited by cost. Therefore, simplifications are used in the model break-up and modeling of thermal performance of components, the impact of which on the calculations is discussed. Some experience gathered with the model in remote data handling and assessment of results is discussed and further development is mentioned. Author (ESA)

N79-31291# Aeritalia S.p.A., Torino (Italy).
ANALYSIS OF FLUID LOOPS INCLUDING TRANSPORT TIME-LAG SIMULATION
S. DellAmico and B. Sessions *In* ESA Spacecraft Thermal and Environ. Control Systems Oct. 1978 p 213-222 refs (For primary document see N79-31266 22-18)
Avail: NTIS HC A99/MF A01

Analog network methods of solution and corresponding digital programming techniques that enable the simulation of fluid loop heat transfer and fluid transport time (time-lag) in non-adiabatic fluid passages are discussed. The analysis techniques presented can be used for the thermal simulation of active thermal control loops (fluid loop) to obtain the correct performance of a thermal control system. Techniques discussed in this paper were applied to the SINDA computer program but are valid for most thermal analyzer programs that employ finite difference routines. The methods presented are useful in solving thermal problems involving fluid flow for both space-orbit applications (e.g., heat exchangers, radiators, and complete loops) and earth bound applications (e.g., solar heating and cooling systems). Author (ESA)

N79-31292# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
THE SPACELAB AVIONICS LOOP
R. Sosnay *In* ESA Spacecraft Thermal and Environ. Control Systems Oct. 1978 p 223-229 ref (For primary document see N79-31266 22-18)
(Contract ERNO-CC-DS-000-1-00)
Avail: NTIS HC A99/MF A01

The Avionics Loop was developed to provide air cooling to a large variety of equipment flown on Spacelab. It is designed to provide a maximum amount of versatility, enabling a totally different set of experiments to be flown on every mission. A description of the Avionics Loop and hardware, a rough description of how the loop must be balanced, and some of the major analyses and tests used to develop and verify the entire system are included. Author (ESA)

N79-31293# Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany).
PROBLEMS OF THERMAL RADIATION ENVIRONMENT MODELING OBSERVED IN SPACELAB ANALYSES
J. P. Hoffman *In* ESA Spacecraft Thermal and Environ. Control Systems Oct. 1978 p 231-238 refs (For primary document see N79-31266 22-18)
Avail: NTIS HC A99/MF A01

An investigation into the accuracy of the temperature predictions for the radiation dominated environment of Spacelab is presented. It is shown that the two parameters the analyst has control of, radiation constant and heat rate calculations, must be evaluated separately. Due to the high impact on computer costs the elemental breakdown must be sized carefully. It is also shown that with highly reflecting surfaces which are partly shaded, the breakdown of the nodes is of great importance for the accuracy of temperature predictions. Author (ESA)

N79-31294# European Space Research and Technology Center, Noordwijk (Netherlands).
THERMAL EFFECTS ON STRUCTURAL DESIGN
K. vanKatwijk and J. K. Bennett (British Aerospace Dyn. Group., Stevenage) *In* ESA Spacecraft Thermal and Environ. Control Systems Oct. 1978 p 239-247 (For primary document see N79-31266 22-18)
Avail: NTIS HC A99/MF A01

The effects of thermal control on structural design are discussed. Reduced material properties, thermal loading, geometrical changes, and increased friction were found to the effects of temperature range and distribution. The thermal mechanical interaction lead to a certain design requirements interpretation and to verification by analysis and mechanical thermal studies are presented for better understanding of these thermal control and structural design interactions. Author (ESA)

N79-31295# Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost.
THERMO-OPTICAL STABILITY OF THE HARD X-RAY IMAGE SPECTROMETER FOR THE SOLAR MAXIMUM MISSION
R. J. Haman and C. Blaas *In* ESA Spacecraft Thermal and Environ. Control Systems Oct. 1978 p 249-254 refs (For primary document see N79-31266 22-18)
Avail: NTIS HC A99/MF A01

The optimization of the thermo-optical stability of the hard X-ray imaging spectrometer for the Solar Maximum Mission is described. The implications of the use of the statically determined design principle were studied. The limitations of orthodox analysis tools as multi-nodal temperature prediction programs and NASTRAN stuctural analysis program with respect to optimization are shown. As an illustration the structural and thermal design of HXIS is described. Author (ESA)

N79-31296# Aeritalia S.p.A., Torino (Italy).
SPACELAB ACTIVE THERMAL CONTROL LOOP COMPONENTS DESIGN AND DEVELOPMENT
L. Costamagna and M. Bellomo (Microtecnica) *In* ESA Spacecraft Thermal and Environ. Control Systems Oct. 1978 p 257-269 refs (For primary document see N79-31266 22-18)
Avail: NTIS HC A99/MF A01

The development of the active thermal control components for Spacelab is described. The active components were optimized within the system needs in terms of weight, pressure drop, thermal performance, interface constraints, and hardware life. The specific design requirements and the optimization techniques utilized are described together with the final design approach and the results of the development phase. Author (ESA)

N79-31297# Microtecnica, Turin (Italy).
COLD PLATES FOR SPACECRAFT APPLICATIONS
P. Scripelliti and M. Bellomo *In* ESA Spacecraft Thermal and Environ. Control Systems Oct. 1978 p 271-284 refs (For primary document see N79-31266 22-18)

Avail: NTIS HC A99/MF A01

The studies and tests performed for the design of cold plates that dissipate heat from Spacelab experiments and avionics equipment are described. The main design criteria was to find the best compromise between performances, weight, dimensions and interface requirements. Author (ESA)

N79-31298# Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany).

THERMAL INTERFACE CONDUCTANCE ON LIQUID COOLED COLD PLATES FOR SPACELAB

B. Schwarz *In* ESA Spacecraft Thermal and Environ. Control Systems Oct. 1978 p 285-292 refs (For primary document see N79-31266 22-18)

Avail: NTIS HC A99/MF A01

The thermal interface conductances experimentally determined for typical Spacelab applications are presented. It is shown how various interface fillers, especially a gas between the contacting surfaces, improve the conductance. Author (ESA)

N79-31299# Nord-Micro Elektronic Feinmechanik G.m.b.H., Frankfort (West Germany).

THE SPACELAB AVIONICS FAN AND HEAT EXCHANGER ASSEMBLIES

R. Schaefer *In* ESA Spacecraft Thermal and Environ. Control Systems Oct. 1978 p 293-300 (For primary document see N79-31266 22-18)

Avail: NTIS HC A99/MF A01

Hardware functions and performance of the Avionics Fan and Heat Exchanger Assemblies, which are part of the Spacelab Environmental Control Life Support Subsystem, are described. The main purpose of the Avionics Fan and Heat Exchanger Assemblies is to provide sufficient airflow for the forced convection cooling of the Spacelab avionics and to transfer the avionics heat load to the Spacelab water loop. The avionics to be cooled include mission dependent as well as subsystem dedicated equipment. Assembly instrumentation allows equipment monitoring during flight and on the ground. Author (ESA)

N79-31300# Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany).

AUDIBLE NOISE CONTROL IN SPACELAB AS PART OF MANNED SPACECRAFT ENVIRONMENTAL CONTROL

D. Eilers, D. Wyn-Roberts (ESTEC), and I. U. Borchers (Dornier-Werke G.m.b.H., Friedrichshafen, West Germany) *In* ESA Spacecraft Thermal and Environ. Control Systems Oct. 1978 p 301-317 refs (For primary document see N79-31266 22-18)

Avail: NTIS HC A99/MF A01

The approach used to obtain a controlled low ambient noise level in the Spacelab module is described. During the course of development of this program the fans of the cabin air and avionics cooling systems of the Environmental Control Subsystem (ECS) were identified as being major noise sources leading to unacceptable high noise levels in the module. Analysis of noise generating paths led to noise control recommendations including lining of duct work, incorporation of mufflers, incorporation of anti-vibration mounts and wrapping of fan casings. Noise reduction of about 20 dB was obtained. Results of the analysis and testing, especially in the ECS area, are discussed in detail. Author (ESA)

N79-31301# Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany).

THE DESIGN AND DEVELOPMENT OF A HIGH PERFORMANCE THERMAL INSULATION FOR THE EUROPEAN SPACELAB

A. J. Martin, R. Meyer, and D. Boggiatto (Aeritalia) *In* ESA Spacecraft Thermal and Environ. Control Systems Oct. 1978 p 319-330 refs (For primary document see N79-31266 22-18)

Avail: NTIS HC A99/MF A01

The selection, design, and development of a high performance thermal insulation suitable for use on the Spacelab currently under development is described. The initial requirements which were specified for the insulation are reviewed. In the study phase several insulation concepts were assessed and a brief description of the main contenders is given together with the rationale which led to the final selection of the insulation type to be used. Specific design details of this insulation are then presented. The thermal performance of the insulation is described by the presentation of results from tests which were performed on flight standard hardware. The importance of the insulation's performance to the overall Spacelab thermal control system is indicated in reference to the results of thermal analysis. Author (ESA)

N79-31302# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).

IMPROVED ALPHA-S STABILITY OF SECOND SURFACE MIRRORS AND OPTICAL SOLAR REFLECTORS PROTECTED BY THIN ZnS COATINGS OR A SELECTED INTERFERENCE FILTER AS A TOP LAYER, AND THE CONDUCTIVITY OF In2O3 ON SECOND SURFACE MIRRORS

O. K. Husmann, K. Kerner (Bosch (Robert) G.m.b.H.), and J. Naegele (Dent. Balzers) *In* ESA Spacecraft Thermal and Environ. Control Systems Oct. 1978 p 331-338 refs Sponsored by DFVLR, Cologne (For primary document see N79-31266 22-18)

Avail: NTIS HC A99/MF A01

To retard alpha-S deterioration, thin film coatings were deposited on Teflon second surface mirrors (SSM). Candidate materials for these shields are ZnS and Al2O3. ZnS absorbs the UV radiation below 350nm and improves the Teflon FEP alpha-S stability. An IF filter in addition increases the reflectance in selected spectral ranges. ZnS and an IF filter-protected SSM show improved alpha-S stability under simulated solar radiation exposure, independent of the UV intensities between 7.5 solar constants and 2 solar constants over 3000 equivalent sun hours. Static charging of such dielectric surfaces under particle irradiation can lead to electric discharges and to interference with the satellite communications systems. To eliminate such charges, conductive coatings are vapor deposited on the outside of thermal control surfaces. Fractures within the protective coating lead to new problems in conjuncture with their surface conductivity. Author (ESA)

N79-31303# Aeritalia S.p.A., Torino (Italy).

BREADBOARD DEVELOPMENT TEST OF SPACELAB ATCS

P. Messidoro and L. Battocchio *In* ESA Spacecraft Thermal and Environ. Control Systems Oct. 1978 p 341-354 refs (For primary document see N79-31266 22-18)

Avail: NTIS HC A99/MF A01

The Spacelab Active Thermal Control Subsystem and its Ground Support Equipment (ATCS/GSE) development program foresees a subsystem verification test called Water and Freon Loop Breadboard. The verification of thermal and hydraulic performances and the determination of their design maximum capabilities are the main purposes of the ATCS breadboard. The comparison of the test results with respect to the analytical predictions shows satisfactory agreement. A description of the test configurations (test article, simulators, instrumentation and support equipment), an explanation of the test procedure (subdivided into GSE testing, flight simulation, off-design cases and operational verification), an investigation of the major test results compared with the suitable analyses and a series of final conclusions are presented. Author (ESA)

N79-31304*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

A REGENERABLE CO2 AND HUMIDITY CONTROL SYSTEM FOR EXTENDED DURATION ORBITER MISSIONS

F. H. Samonski and H. F. Brose (Hamilton Std., Windsor Locks, Conn.) *In* ESA Spacecraft Thermal and Environ. Control Systems Oct. 1978 p 355-363 refs (For primary document see N79-31266 22-18)

Avail: NTIS CSCL 22B

A regenerable CO2 and humidity control system was developed for on-orbit operations in the Space Shuttle Orbiter environmental control and life support system as an alternate to the baseline lithium hydroxide (LiOH) system. The system utilizes a solid amine sorbent material to remove CO2 and water vapor from the cabin atmosphere and desorb the CO2 and water vapor to space vacuum. Continuous operation is achieved by utilizing two beds which are cycled between adsorption and desorption. Cyclic capacities of 2 percent (of solid amine material weight) for CO2 and 4 percent for water vapor are achieved using nominal cabin conditions. The fabrication and testing of a flight prototype canister and flight prototype vacuum valves shows

the feasibility of these full-size, light weight components.
Author (ESA)

N79-31305# Fairchild Industries, Inc., Germantown, Md.
THERMAL DESIGN, ANALYSIS, AND PERFORMANCE OF A SOLID PROPELLANT SPIN SYSTEM
H. Hwangbo (MJR, Inc., McLean, Va.), R. J. Eby, and P. R. Summer (Atlantic Res. Corp., Gainesville, Fla.) *In* ESA Spacecraft Thermal and Environ. Control Systems Oct. 1978 p 365-373 refs (For primary document see N79-31266 22-18)
Avail: NTIS HC A99/MF A01

An evaluation of a solid propellent spin system which consists of a gas generator and a remote nozzles assembly connected by tubular lines is presented. The system was employed in the various Space Test Program flights as a means for attitude stabilization and for supplementing the upper stage separation velocity. Computer modeling of ballistic, thermal, and fluid flow characteristics and performance predictions in the flight environment are discussed. The validity of the analysis is verified by comparison of predictions with test and flight data. The results are used for stress analysis of the gas generator line assemblies and a thermal stress relief design of the spin system is discussed in detail. Author (ESA)

N79-31306# Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany).
THE OTS HYDRAZINE REACTION CONTROL SYSTEM THERMAL CONDITIONING TECHNIQUE
D. Stuempel *In* ESA Spacecraft Thermal and Environ. Control Systems Oct. 1978 p 375-382 refs (For primary document see N79-31266 22-18)
Avail: NTIS HC A99/MF A01

Late development of OTS reaction control subsystems (RCS) thermal control is described. The final concept uses eight telecommand switches, provides separate heater operation for the redundant RCS branches, needs heater power only during sunlight periods of the mission, and maintains the temperatures of all components safely above the freezing point during all mission phases, including the critical transfer orbit and eclipse periods, without reaching unacceptable high temperatures under warm conditions. Experimental flight data show that the system performs within specifications. Author (ESA)

N79-31307# Fulmer Research Inst. Ltd., Stoke Poges (England).
ADVANCED PROCEDURES FOR THE MEASUREMENT OF SURFACE TEMPERATURES USING COPPER VERSUS CONSTANTAN THERMOCOUPLES
J. C. Kevern, B. A. Hatt, J. K. R. Page, B. Aalders (ESTEC), and J. B. Walker (ESTEC) *In* ESA Spacecraft Thermal and Environ. Control Systems Oct. 1978 p 383-386 (For primary document see N79-31266 22-18)
Avail: NTIS HC A99/MF A01

Results of related development studies which lead to improvements in the technology of temperature measurement in spacecraft testing are presented. The method for manufacturing a copper versus constantan thermocouple was established. Special features of the design include a tapered wire section to provide a low thermal mass at the junction tip and low conduction losses without sacrificing either robustness or calibration accuracy of the units. Subsequent development of reliable procedures for attaching such low-mass thermocouples to a wide range of spacecraft surfaces is also described. This has successfully resulted in standard attachment procedures for all surfaces and these procedures will be assessed under vacuum thermal cycling conditions. Author (ESA)

N79-31308# European Space Research and Technology Center, Noordwijk (Netherlands).
ECONOMIC USE OF FACILITIES FOR THERMAL TESTING OF LARGE SATELLITES AND SUBSYSTEMS
P. W. Brinkman, W. A. Schickle, and J. B. Walker *In* ESA Spacecraft Thermal and Environ. Control Systems Oct. 1978 p 387-396 (For primary document see N79-31266 22-18)
Avail: NTIS HC A99/MF A01

The problem of increasing costs of thermal testing of large satellites or subsystems is discussed. Unless specific actions are taken, these costs will represent a greater proportion of a satellite program's in the future. A brief history of past test costs is presented and reasons for the expected increasing costs are defined. Increasing size of future satellites and higher test facility cost rates are identified as causes of the problem. Attention is directed towards the possible means of alleviating the problem. The way this can be done is described and developed and some practical examples are given of both software and hardware optimization. It is concluded that test requirements and methods must be given early attention in a satellite program.
Author (ESA)

N79-31309# Politecnico di Torino (Italy).
FLUID LOOPS FOR THERMAL PAYLOAD CONTROL
F. Filippi *In* ESA Spacecraft Thermal and Environ. Control Systems Oct. 1978 p 399-409 refs (For primary document see N79-31266 22-18)
Avail: NTIS HC A99/MF A01

The advantages of fluid loops for thermal control of payloads onboard spacecrafts are presented. Their main features are briefly discussed and it is shown that accurate payload temperature control can be achieved only through active control systems involving fairly sophisticated digital control units. The modular approach to construction of fluid loop thermal control systems is stressed and, as an example, a brief description is given of the experiment cooling loop for thermal conditioning of Spacelab payloads. Author (ESA)

N79-31310# Aeritalia S.p.A., Torino (Italy).
SELECTION OF COOLANT FOR SPACELAB EXPERIMENT THERMAL CONTROL LOOPS
L. Guerra and M. Andriano (Microtecnica) *In* ESA Spacecraft Thermal and Environ. Control Systems Oct. 1978 p 411-423 refs (For primary document see N79-31266 22-18)
Avail: NTIS HC A99/MF A01

The selection of fluids to be used in various sections of the Spacelab Experiment Cooling Loop (ECL) is discussed. General considerations on fluid screening are presented (toxicity, materials compatibility, etc.) followed by fluid selection criteria on toxicity rating, thermal stability, pumping power, viscosity, materials compatibility, and handling for use on a pallet mounted ECL and for a supplementary cooling assembly (SCA) refrigerant fluid. It is shown that freon El was best adapted for the pallet mounted ECL while no definite advantage was found between R-12 and R-114 for the SCA refrigerant fluid. Author (ESA)

N79-31311# Microtecnica, Turin (Italy).
THERMAL FLUID LOOPS FOR SPACE APPLICATIONS. A LINEAR CONTROL SYSTEM STABILITY APPROACH
V. Marchis *In* ESA Spacecraft Thermal and Environ. Control Systems Oct. 1978 p 425-429 refs (For primary document see N79-31266 22-18)
Avail: NTIS HC A99/MF A01

A linear control system approach to study the thermal system stability of fluid loops used on spacecraft to control the temperature of experiments is presented. The system studied is the Experiment Cooling Loop used on the Spacelab to control the experiment temperature. Transfer functions of its various components are reported. A review of Nyquist plots calculated at various working points shows the dynamic behavior of the loop. Author (ESA)

N79-31312# Microtecnica, Turin (Italy).
DYNAMIC BEHAVIOR OF A FLUID LOOP WITH A PELTIER SUPPLEMENTARY COOLING ASSEMBLY
V. Marchis *In* ESA Spacecraft Thermal and Environ. Control Systems Oct. 1978 p 431-438 refs (For primary document see N79-31266 22-18)
Avail: NTIS HC A99/MF A01

A dynamic computer model for simulation of thermal transients on a fluid loop in which a Peltier cooler has been installed is presented for application to fluid loops used to control the temperature of assemblies or experiments located in the spacecraft. When the source temperature must be maintained at a value lower than the heat sink a cooling system becomes necessary. It is shown that Peltier coolers offer some advantages for low values of heat rejection. Author (ESA)

N79-31313# Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany).

AN ACTIVE MODULAR TEMPERATURE GRADIENT CONTROL SYSTEM

H. Klotz and K. Marke *In* ESA Spacecraft Thermal and Environ. Control Systems Oct. 1978 p 439-448 refs (For primary document see N79-31266 22-18)
Avail: NTIS HC A99/MF A01

An electrical heater system for active high precision control of temperature and the local temperature gradient for spacecraft parts and equipment is presented. A mathematical model is developed for the thermal behavior of a thin aluminum plate partitioned into four subsystems, each of them equipped with a separate heater element. A discussion and comparison of different control system conceptions is carried out, which leads to the definition of a modular control system with the special features of low power and flexibility. The selected solution is characterized by a decentralized control scheme with a separate controller for each subsystem, and an optimal additional unit for the generation of a variable set value for the energy saving mode of pure gradient control. The controller itself is based on the pulse width modulation principle. The detailed design of the controller as a part of a modular gradient control system is given and a microprocessor implementation is proposed. Author (ESA)

N79-31314# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).

DEVELOPMENT OF A MOVABLE, THERMALLY CONDUCTING JOINT FOR APPLICATION TO DEPLOYABLE RADIATORS

B. Hinderer and C. J. Savage (ESTEC) *In* ESA Spacecraft Thermal and Environ. Control Systems Oct. 1978 p 449-452 (For primary document see N79-31266 22-18)
Avail: NTIS HC A99/MF A01

The development of a thermal joint concept for radial heat transfer from a fixed feeder to a deployable radiator is presented. A critical comparison of several imaginable techniques considered from thermal and mechanical points of view shows that most favorable results with regard to thermal efficiency and low deployment torques can be expected using a mixture of conductive grease and silver powder as interface filler between feeder and rotor. The design of a technological model based on these investigations is described and the results of a thermal-vacuum-test are given. Radial temperature drops and measured torques proved to be acceptable within the required ranges of temperature and radial heat flux density. Author (ESA)

N79-31315# Aeritalia S.p.A., Torino (Italy).

SPACELAB FLUID LOOP RADIATOR SYSTEM DESIGN AND ANALYSES

L. Bussolino and B. Sessions *In* ESA Spacecraft Thermal and Environ. Control Systems Oct. 1978 p 453-464 refs (For primary document see N79-31266 22-18)
Avail: NTIS HC A99/MF A01

Research on radiator systems for on module mounted and on pallet mounted applications to increase the Spacelab heat rejection capability and to provide a first step improvement towards the medium-long term Spacelab free flyer concept are discussed. Design characteristics and analyses results are given for fixed radiator system mounted on the module core upper half and for a multipanel deployable radiator system mounted on the pallet for an extended heat rejection capability. Author (ESA)

N79-31316*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

EXPERIMENTAL CONTROL REQUIREMENTS FOR LIFE SCIENCES

W. E. Berry and J. C. Sharp *In* ESA Spacecraft Thermal and Environ. Control Systems Oct. 1978 p 467-472 (For primary document see N79-31266 22-18)
Avail: NTIS HC A99/MF A01 CSCL 22B

The Life Sciences dedicated Spacelab will enable scientists to test hypotheses in various disciplines. Building upon experience gained in mission simulations, orbital flight test experiments, and the first three Spacelab missions, NASA will be able to progressively develop the engineering and management capabilities necessary for the first Life Sciences Spacelab. Development of experiments for these missions will require implementation of life-support systems not previously flown in space. Plant growth chambers, animal holding facilities, aquatic specimen life-support systems, and centrifuge-mounted specimen holding units are examples of systems currently being designed and fabricated for flight. Author (ESA)

N79-31317# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).

HIGH PERFORMANCE REQUIREMENTS FOR THE THERMAL CONTROL SUBSYSTEM OF THE FAINT OBJECT CAMERA

W. Erne and W. J. Schwarzott *In* ESA Spacecraft Thermal and Environ. Control Systems Oct. 1978 p 473-480 (For primary document see N79-31266 22-18)
Avail: NTIS HC A99/MF A01

The main thermal design features according to the present development status of the Faint Object Camera are described. High optical performance requirements for this camera demand low thermal distortion properties of structural parts and cooling of the detector cathode. The temperature stabilization system of the Optical Bench Enclosure, the Photon Detector Assembly including the cooling system for the intensifier window and the electronics thermal control are presented. The applications of heater systems superinsulations, Peltier elements, heat pipes, and radiators are examined. Author (ESA)

N79-31318*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

AN ASSESSMENT OF THERMAL DESIGN PROCEDURES FOR SHUTTLE PAYLOADS

D. W. Almgren, J. T. Bartoszek, and H. P. Lee *In* ESA Spacecraft Thermal and Environ. Control Systems Oct. 1978 p 481-486 Prepared in cooperation with Little (Arthur D.), Inc., Cambridge, Mass. (For primary document see N79-31266 22-18)
Avail: NTIS HC A99/MF A01 CSCL 22B

A review of the thermal design options for unmanned Shuttle payloads is presented. Because many future Shuttle payloads will have budgets and less time available for the definition of their thermal subsystems, simplified design procedures will be the most cost-effective. The thermal interface between an individual payload and the Orbiter is discussed. A simplified, modular thermal control system that will reduce the cost of providing thermal protection by minimizing both the initial procurement cost of any specialized hardware and the need for a detailed thermal interface analysis is described. Author (ESA)

N79-31319*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THERMAL DESIGN ANALYSIS OF SHUTTLE CARGO BAY PAYLOADS

J. T. Bartoszek, D. W. Almgren, M. Coyle, and D. Mengers *In* ESA Spacecraft Thermal and Environ. Control Systems Oct. 1978 p 487-493 Prepared in cooperation with Little (Arthur D.), Inc., Cambridge, Mass. (For primary document see N79-31266 22-18)
(Contract NAS5-23392)
Avail: NTIS HC A99/MF A01 CSCL 22B

The thermal design analysis methodology, the thermal control philosophy, and preliminary thermal analysis results associated with specific shuttle payloads are presented. The payloads considered are the Get-Away Special canisters being developed by NASA Goddard, which may be flown on a variety of missions, and the six experiments which are mounted on the GSFC pallet to be flown on Operational Flight test No. 4 (OFT-4). The thermal control alternatives currently available to OFT-4 instruments are the use of pallet cold plates (if available) or operational constraints which allow passive thermal control without the use of excessive heater power. The characteristics of a completely passive thermal control design are evidenced by the results of the Get-Away Special canister analysis.
Author (ESA)

N79-31320# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).

THE SPACE PROCESSING LAB AND ITS HEAT TRANSFER SUBSYSTEM

P. Zimmerman *In* ESA Spacecraft Thermal and Environ. Control Systems Oct. 1978 p 495-499 Sponsored by Bundesmin. fuer Forsch. u. Technol. and DFVLR (For primary document see N79-31266 22-18)

Avail: NTIS HC A99/MF A01

The Space Processing Lab project of the German Shuttle/Spacelab Utilization Mission is described. It is to be flown on the first Spacelab mission and is the first opportunity for material science and space processing experimenters to perform their experiments without major limitations under near zero gravity. The German contribution consists of an Isothermal Heating Facility, a Mirror Heating Facility, a Cryostat, a High Temperature Thermostat, and common equipment for cooling, vacuum, gas, data management, and power. The nonGerman contributions are a Gradient Heating Facility, a Fluid Physics Module, a UHV-Chamber, and a Capillarity Measurement Equipment.

Author (ESA)

N79-31321# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).

THE SPACELAB RACK COOLING SYSTEM

M. Bader *In* ESA Spacecraft Thermal and Environ. Control Systems Oct. 1978 p 501-504 (For primary document see N79-31266 22-18)

(Contract ERNO-CC-DS-000-1-00)

Avail: NTIS HC A99/MF A01

The function, layout, and usage possibilities of the Spacelab Rack Cooling System is described. This system provides adequate air flow for cooling of rack mounted equipment in a zero-g environment. Cold air enters the rack and is distributed into a free stream of low velocity. This cool air is sucked through the equipment. The warmed air returns to the avionics loop via return ducts. The actual hardware of this system is described and an integration and adjustment concept is presented which has proven its feasibility during development tests. Author (ESA)

N79-31322*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

CRYOGENIC HELIUM 2 SYSTEMS FOR SPACE APPLICATIONS

E. Urban, L. Katz, J. Hendricks (Alabama Univ.), and G. Karr (Alabama Univ.) *In* ESA Spacecraft Thermal and Environ. Control Systems Oct. 1978 p 507-515 refs (For primary document see N79-31266 22-18)

Avail: NTIS HC A99/MF A01 CSCL 22B

Two cryogenic systems are described which will provide cooling for experiments to be flown on Spacelab 2 in the early 1980's. The first system cools a scanning infrared telescope by the transfer of cold helium gas from a separate superfluid helium storage dewar. The flexible design permits the helium storage dewar and transfer assembly to be designed independent of the infrared experiment. Where possible, modified commerical apparatus is used. The second cryogenic system utilizes a specially designed superfluid dewar in which a superfluid helium experiment chamber is immersed. Each dewar system employs a porous plug as a phase separator to hold the liquid helium within the dewar and provide cold gas to a vent line. To maintain the low vapor pressure of the superfluid, each system requires nearly continuous prelaunch vacuum pump service, and each will vent to space during the Spacelab 2 flight. Author (ESA)

N79-31323# Messerschmidt-Boelkow G.m.b.H., Munich (West Germany).

DESIGN AND THERMAL CONTROL CONCEPT OF A He2 CRYOSTAT FOR SPACE APPLICATION (GIRL)

A. Seidel *In* ESA Spacecraft Thermal and Environ. Control Systems Oct. 1978 p 517-519 (For primary document see N79-31266 22-18)

Avail: NTIS HC A99/MF A01

A compilation of the illustrative material utilized at a conference on the subject is presented. Definitions, a list of main subsystems, the planned instrumentation, a list of cryostat requirements and concepts, and the program phases are included. Author (ESA)

N79-31324# European Space Research and Technology Center, Noordwijk (Netherlands).

THE HELIUM 2 CRYOSTAT FACILITY FOR SPACELAB PAYLOADS

J. Lizon-Tati and M. Girard (SNIAS, Cannes, France) *In* ESA Spacecraft Thermal and Environ. Control Systems Oct. 1978 p 521-525 (For primary document see N79-31266 22-18)

Avail: NTIS HC A99/MF A01

The development program of the Superfluid Helium Cryostat for space use has been undertaken to provide a cryogenic facility to be used on Spacelab for cooling of scientific payloads down to 2K. The main technical specification is to maintain HE 2 at 1.6K in orbit during 30 days with a 40 mW average experiment heat dissipation and a low heat input via an optical opening. This cryostat is planned to be flown on board one of the Spacelab demonstration missions with a passenger experiment (mid 1982). The program objectives and the work performed by the industrial team during the design phase is presented as well as the selected baseline design. The development plan for the hardware phase is also briefly described. Author (ESA)

N79-31325# Centre National d'Etudes Spatiales, Toulouse (France).

SPACEBORNE CRYOGEN COOLER FOR IR DETECTORS

A. Rolfo and R. Prost (Air Liquide) *In* ESA Spacecraft Thermal and Environ. Control Systems Oct. 1978 p 527-530 In FRENCH (For primary document see N79-31266 22-18)

Avail: NTIS HC A99/MF A01

Testing methods and first results of a sublimable solid cryostat developed for cooling an infrared detector to 60/110 K for up to several months on a satellite are described. The design is discussed, showing that both with NH3 or CH4 the calculated autonomy is longer than the 3 months specified. The first tests show an actual life of about two months for which thermal losses were investigated. Author (ESA)

N79-31326# Technische Universitaet, Munich (West Germany). Lehrstuhl fuer Thermodynamik.

CRYOCONTAMINATION OF LIQUID NITROGEN COOLED TELESCOPES

E. R. F. Winter and W. Tuzinsky *In* ESA Spacecraft Thermal and Environ. Control Systems Oct. 1978 p 531-537 refs (For primary document see N79-31266 22-18)

Avail: NTIS HC A99/MF A01

Simulation of heat and mass transfer together with interferrometric studies of cryodepositing and its prevention were performed in order to improve cryogenically cooled detectors employed in telescopes stationed outside the dense atmosphere for infrared astronomy. A Cassegrain type model of a balloon-borne telescope was used. Deposit rates on the mirrors, kept at 80K, were measured. Counter flow with gaseous nitrogen reduced the rate of cryodeposition. Author (ESA)

N79-31327# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).

INTEGRATION AND TEST OF PAYLOAD ELEMENTS FOR FLIGHTS IN THE SHUTTLE CARGO BAY

A. vonBreitenstein *In* ESA Spacecraft Thermal and Environ. Control Systems Oct. 1978 p 541-544 (For primary document see N79-31266 22-18)

Avail: NTIS HC A99/MF A01

System integration of space shuttle payloads is analyzed. Payloads are classified in the categories of payloads mounted directly in the cargo bay, payloads mounted on space pallets, payloads deployed out of the cargo bay, and upper stage payloads. Each of these categories is analyzed separately. Special features are identified in providing to the user community an efficient supporting service during the integration process of individual experiments/facilities to one combined payload element ready to be flown in the Shuttle. Author (ESA)

N79-31328*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

THERMAL INTEGRATION OF SPACELAB EXPERIMENTS

W. C. Patterson and G. D. Hopson *In* ESA Spacecraft Thermal and Environ. Control Systems Oct. 1978 p 545-559 refs (For primary document see N79-31266 22-18)

Avail: NTIS HC A99/MF A01 CSCL 22B

The method of thermally integrating the experiments for Spacelab is discussed. The scientific payload consists of a combination of European and United States sponsored experiments located in the module as well as on a single Spacelab pallet. The thermal integration must result in accomodating the individual experiment requirements as well as ensuring that the total payload is within the Spacelab Environmental Control System

(ECS) resource capability. An integrated thermal/ECS analysis of the module and pallet is performed in concert with the mission timeline to ensure that the agreed upon experiment requirements are accommodated and to ensure the total payload is within the Spacelab ECS resources. Author (ESA)

N79-31329# Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany).
FUTURE TRENDS IN COMMUNICATION SPACECRAFT THERMAL CONTROL
J. Guelpen *In* ESA Spacecraft Thermal and Environ. Control Systems Oct. 1978 p 563-573 refs (For primary document see N79-31266 22-18)
Avail: NTIS HC A99/MF A01

A scenario of future space communication systems is outlined and its consequences on the thermal control subsystem of communication spacecraft are discussed. These consequences are expected in three areas, namely the increased economic competition on the market, the trend to high power payloads, and the use of the manned, reuseable space transportation system. Thermal control techniques available or under development to cope with future demands are highlighted. Author (ESA)

N79-31330*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THERMAL/ENVIRONMENTAL CONTROL AND LIFE SUPPORT SYSTEM REQUIREMENTS FOR FUTURE SPACE APPLICATION
U. Hueter *In* ESA Spacecraft Thermal and Environ. Control Systems Oct. 1978 p 575-582 refs (For primary document see N79-31266 22-18)
Avail: NTIS HC A99/MF A01 CSCL 22B

Thermal/environmental control systems concepts being considered for the power module and manned orbital facilities are described. To assure an economically viable program, the approach being pursued is utilization of existing hardware, where possible, and construction of orbital facilities in modular fashion to meet anticipated growth of space processing, astronomy, life science, solar/terrestrial observation, construction, etc. Configurations include Orbiter tended missions (Orbiter remains attached to orbiting facility) and freeflying manned or unmanned earth-orbiting facilities. Utilization of shuttle hardware, e. g., external tank, or the currently orbiting Skylab vehicle is being considered for orbital facilities. Studies include use of Spacelab hardware with a power module to permit extending on-orbit mission time beyond the capability of the current space transportation system. Power levels of 25 kW are being considered for the power module. Mission duration is not limited due to the modular approach and the concept of utilizing a logistics module to provide consumables' resupply capability to the orbital facility.
Author (ESA)

N79-31331# Hamilton Standard, Windsor Locks, Conn.
A PROJECTION OF FUTURE MANNED SPACECRAFT ENVIRONMENTAL CONTROL SYSTEMS
M. A. Shuey *In* ESA Spacecraft Thermal and Environ. Control Systems Oct. 1978 p 583-591 refs (For primary document see N79-31266 22-18)
Avail: NTIS HC A99/MF A01

The history of spacecraft environmental control and life support systems up through the current space transportation system is reviewed. Anticipated changes and improvements to the space transportation system for greater mission capability and future environmental control system technology trends for shuttle tended modules, free flying manned spacecraft, and permanent manned orbiting space facilities are discussed. Author (ESA)

N79-31332# Aeritalia S.p.A., Torino (Italy).
EVOLUTIONARY STEPS OF THE SPACELAB THERMAL CONTROL SYSTEM TOWARDS THE SPACE STATION
E. Vallerani and B. Sessions *In* ESA Spacecraft Thermal and Environ. Control Systems Oct. 1978 p 593-600 refs (For primary document see N79-31266 22-18)
Avail: NTIS HC A99/MF A01

The baseline Spacelab Thermal Control System (TCS) requirements, design, and capabilities, and possible extension capabilities, expected improvements, and the stepwise approach for the evolution to a space station consisting of Spacelab building blocks are described. Information is presented concerning the extension of Spacelab TCS capabilities and performances which can be implemented on a near, medium, and long term basis.
Author (ESA)

N79-31333# European Space Agency, Noordwikj (Netherlands).
THERMAL CONTROL SOFTWARE AT ESA/ESTEC
C. Stroom *In* ESA Spacecraft Thermal and Environ. Control Systems Oct. 1978 p 603-604 (For primary document see N79-31266 22-18)
Avail: NTIS HC A99/MF A01

An overview of existing and planned software at ESA/ESTEC for thermal analysis is presented. The thermal mathematical models (TMM) which are used for temperature prediction include software to calculate radiative exchanges and incident heat fluxes, thermal analysis programs, TMM management programs, and TMM correction/evaluation programs. The desirability of the use of common software, avoiding duplication, and simplifying the interface with models used by the industry, is stressed.
Author (ESA)

N79-31334# Madrid Univ. (Spain).
SPACECRAFT THERMAL CONTROL DESIGN DATA
I. Da-Riva, J. Meseguer, I. Martinez, and C. Stroom (ESTEC) *In* ESA Spacecraft Thermal and Environ. Control Systems Oct. 1978 p 605-612 (For primary document see N79-31266 22-18)
Avail: NTIS HC A99/MF A01

The status of a compilation program for thermal control design data, including a handbook already issued with additions and updating is reviewed. A brief description of the several major subjects is presented, including geometric characteristics of radiation and conduction, properties of materials, and thermal control systems. Author (ESA)

N79-31335# European Space Agency, Noordwikj (Netherlands).
TEMPERATURE LIMITS AND THEIR RELATION TO EQUIPMENT
A. Accensi and C. Stroom *In* ESA Spacecraft Thermal and Environ. Control Systems Oct. 1978 p 613-617 (For primary document see N79-31266 22-18)
Avail: NTIS HC A99/MF A01

A set of terms frequently used in spacecraft thermal control is defined in order to avoid different interpretations given to some terms. These terms are those used to define the interfaces between equipment and spacecraft thermal control, bearing a relationship to temperature limits, temperature test levels, and temperature design margins. Author (ESA)

N79-31336# Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany).
SPACELAB ENVIRONMENTAL CONTROL ASPECTS FOR LONGER DURATION MISSIONS
P. Natenbruk and W. Wienss *In* ESA Spacecraft Thermal and Environ. Control Systems Oct. 1978 p 619-624 (For primary document see N79-31266 22-18)
Avail: NTIS HC A99/MF A01

Some major aspects of prolonged Spacelab missions, which affect the layout of the Spacelab environmental control system, including its life support and thermal control, are discussed. The fact that prolonged flights cannot be treated independent of other capability extensions, such as increased power levels or bigger module volumes, is stressed. It is concluded that missions of up to 20 days duration will need relatively little change, while for longer durations (50 or 80 days) further support systems will be necessary (such as an auxiliary power package, power module, and radiators) and accordingly a significant extension of the Environmental Control System is implied. Author (ESA)

N79-31337# Air Force Geophysics Lab., Hanscom AFB, Mass. Space Physics Div.
SPACECRAFT CHARGING TECHNOLOGY Scientific Interim Report
C. P. Pike 15 May 1979 12 p refs Presented at the IEEE ELECTRO/79 Professional Program
(AD-A069196; AFGL-TR-79-0107) Avail: NTIS HC A02/MF A01 CSCL 22/2

A summary of the problem of spacecraft charging by the ambient space plasma environment is presented. Some results

of the Air Force/NASA spacecraft charging technology investigation are highlighted. Details of an Air Force/NASA spacecraft-environment interactions technology investigation are presented. This investigation will develop an environmental technology base for application to the development of next-generation large dimension, high power spacecraft. GRA

N79-31338# National Aerospace Lab., Amsterdam (Netherlands).
STUDY OF SPACECRAFT ATTITUDE RECONSTITUTION USING THE ESA STARMAPPER
P. T. L. M. vanWoerkom, C. R. Traas, A. L. Bleekrode, F. J. Sonnenschein, and H. Bokhove 1978 212 p refs Prepared in cooperation with Tech. Phys. Dienst TNO-TH
(Contract ESTEC-2383/75-AK)
(NLR-TR-77120-U; ESA-CR(P)-1192) Avail: NTIS HC A10/MF A01

A mathematical model of the rotational dynamics of a rigid, spinning spacecraft is formulated with asymmetry and external torques. A mathematical model of the ESA starmapper is developed with optical-electronic and telemetry effects. A linear, recursive filter for the estimation of spacecraft attitude motion and system parameters is formulated with divergence detection and adaptation. A number of system parameters cannot yet be estimated accurately. Treating these as consider parameters improves the estimation of the spacecraft attitude motion. For small nutation angles, an estimation accuracy of about one arcminute can be achieved. For large nutation angles and large initial attitude errors the estimation process will, in general, diverge due to nonlinearity of the measurement equation. Divergence can be delayed or reduced if measurement noise is increased. A number of improvements related to the starmapper model, filter, and range of applications is suggested. Author (ESA)

N79-31339# Office National d'Etudes et de Recherches Aerospatiales, Leclerc (France). Direction des Etudes de Synthese.
THE INFLUENCE OF ONBOARD LIQUIDS ON THE STABILITY OF EXOSAT PLUS THE ARIANE FOURTH STAGE DURING TRANSFER ORBIT [INFLUENCE DES LIQUIDES EMBARQUES SUR LA STABILITE DU VEHICLE EXOSAT PLUS QUATRIEME ETAGE D'ARIANE EN ORBITE DE TRANSFERT]
J. P. Guibert Feb. 1979 75 p refs In FRENCH
Contract ESTEC-2720/76-NL-AK(SC))
(ONERA-RT-3/6107-SY; ESA-CP(P)-1207) Avail: NTIS HC A04/MF A01

During transfer orbit the vehicle comprised of EXOSAT and the ARIANE fourth stage is unstable due to rotation around the axis of least inertia. The principle cause of this divergence in the angular movement is directly related to the behavior of onboard liquids (two liquid propane tanks and a hydrazine tank with a diaphragm, representing approximately 4% of the total mass). For each type of tank the principle modes affecting the vehicle are modeled and the divergence time constant is evaluated. Results are used to formulate propositions for ground tests. One test involves a turning table for determining the sloshing frequency of the hydrazine tank while another employs gas bearing and is to be used for both the hydrazine and propane tanks.
Author (ESA)

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

N79-31340*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
THE RIM INERTIAL MEASURING SYSTEM (RIMS)
Nelson J. Groom Aug. 1979 20 p refs
(NASA-TM-80100) Avail: NTIS HC A02/MF A01 CSCL 22B

The rim inertial measuring system (RIMS) is introduced and an approach for extracting angular rate and linear acceleration information from a RIMS unit is presented and discussed. The RIMS consists of one or more small annular momentum control devices (AMCDs), mounted in a strapped down configuration, which are used to measure angular rates and linear accelerations of a moving vehicle. An AMCD consists of a spinning rim, a set of noncontacting magnetic bearings for supporting the rim, and a noncontacting electromagnetic spin motor. The approach for extracting angular rate and linear acceleration information is for a single spacecraft mounted RIMS unit.Author

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N79-31341*# Sundstrand Corp., Rockford, Ill.
LIQUID OXYGEN/LIQUID HYDROGEN BOOST/VANE PUMP FOR THE ADVANCED ORBIT TRANSFER VEHICLES AUXILIARY PROPULSION SYSTEM
F. Gluzek, R. G. Mokadam, I. H. To, J. D. Stanitz, and J. Wollschlager Sep. 1979 138 p refs
(Contract NAS3-20401)
(NASA-CR-159648) Avail: NTIS HC A07/MF A01 CSCL 21H

A rotating, positive displacement vane pump with an integral boost stage was designed to pump saturated liquid oxygen and liquid hydrogen for auxiliary propulsion system of orbit transfer vehicle. This unit is designed to ingest 10% vapor by volume, contamination free liquid oxygen and liquid hydrogen. The final pump configuration and the predicted performance are included.
A.W.H.

N79-31342*# Aerojet Liquid Rocket Co., Sacramento, Calif.
DUAL-FUEL, DUAL-THROAT ENGINE PRELIMINARY ANALYSIS Final Report
C. J. OBrien Aug. 1979 235 p refs
(Contract NAS8-32967)
(NASA-CR-161304; Rept-32967F) Avail: NTIS HC A11/MF A01 CSCL 21H

A propulsion system analysis of the dual fuel, dual throat engine for launch vehicle applications was conducted. Basic dual throat engine characterization data were obtained to allow vehicle optimization studies to be conducted. A preliminary baseline engine system was defined. A.W.H.

N79-31343*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SPUTTERING IN MERCURY ION THRUSTERS
Maris A. Mantenieks and Vincent K. Rawlin 1979 20 p refs Presented at 14th Intern. Conf. on Electric Propulsion, Princeton, N. J., 31 Oct. - 2 Nov. 1979; sponsored by AIAA and Deutsche Gesselschaft fur Luft-und Raumfahrt
(NASA-TM-79266; E-181) Avail: NTIS HC A02/MF A01 CSCL 21C

A model, which assumes that chemisorption is the dominant mechanism, is applied to the sputtering rate measurements of the screen grid of a 30 cm thruster in the presence of nitrogen. The model utilizes inputs from a variety of experimental and analytical sources. The model of environmental effects on sputtering was applied to thruster conditions of low discharge voltage and a discussion of the comparison of theory and experiment is presented. M.M.M.

N79-31344# Fairchild Republic Co., Farmingdale, N. Y.
ELECTRODE EROSION PROCESSES IN PULSED PLASMA THRUSTERS Final Report, 15 Aug. 1977 - 31 Jan. 1979
Dominic J. Palumbo, Martin Begun, and William J. Guman Mar. 1979 39 p refs
(Contract F04611-77-C-0024; AF Proj. 3058)
(AD-A069276; MS181R0001; AFRPL-TR-79-14) Avail: NTIS HC A03/MF A01 CSCL 21/8

During the course of this program it was determined that

material melting is the primary physical phenomenon leading to erosion of the anode electrode. Experimentation with various materials indicated that minimum erosion of the anode was obtainable using Poco Graphite but significant impulse bit reduction due to the high resistivity of this material would be incurred if this material were used. The material yielding the next least amount of anode erosion was shown to be copper (OHFC). Various modifications to the thruster propellant/electrode configurations were attempted using graphite in attempting to recover the loss in thruster performance associated with the use of this material as an anode electrode. These attempts were unsuccessful, and the decision was made about midway through the program to concentrate on minimizing the effects of the arc heat load on a copper anode surface by reconfiguring the electrodes and/or propellant rods. This approach to the problem not only led to a successful solution of the anode erosion problem, but also resulted in improved thruster performance and the capability of storing sufficient propellant to meet a total impulse requirement far in excess of the program goal using the original helical rod storage system with modified propellant rod width. GRA

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N79-31345*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CURING AGENT FOR POLYEPOXIDES AND EPOXY RESINS AND COMPOSITES CURED THEREWITH Patent Application
T. T. Serafini and P. Delvigs, inventors (to NASA) Filed 30 Aug. 1979 14 p
(NASA-Case-LEW-12226-1; US-Patent-Appl-SN-070771) Avail: NTIS HC A02/MF A01 CSCL 07C

A curing agent for a polyepoxide is described which contains a divalent aryl radical such as phenylene and a tetravalent aryl radical such as a tetravalent benzene radical. An epoxide is cured by admixture with the curing agent. The cured epoxy product retains the usual properties of cured epoxides and, in addition, has a high char residue after burning, on the order of 45% by weight. The high char residue is of value in preventing release to the atmosphere of carbon fibers from carbon fiber-epoxy resin composites in the event of burning of the composite. NASA

N79-31346*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SURFACE CHEMISTRY OF IRON SLIDING IN AIR AND NITROGEN LUBRICATED WITH HEXADECANE AND HEXADECANE CONTAINING DIBENZYL-DILSULFIDE
Donald R. Wheeler Sep. 1979 15 p refs
(NASA-TP-1545; E-9956) Avail: NTIS HC A02/MF A01 CSCL 11G

Wear experiments were conducted on iron sliding in hexadecane and hexadecane plus one weight percent dibenzyl dilsulfide (DBDS) in atmospheres of air and nitrogen at room temperature. The wear scars and the wear debris were analyzed by X-ray photoelectron spectroscopy. The presence of air reduced wear but increased friction, while DBDS reduced friction but had little effect on wear except that the wear increased somewhat when DBDS was used in air. Wear scar analysis indicated that oxygen and sulfur competed chemically for the surface, with the oxide predominating. Low wear was associated with a thick oxide layer and low friction with a thin predominantly sulfide layer. Analysis of the wear debris indicated the presence of a sulfate in the high wear case (hexadecane plus DBDS in air), and showed the presence of an organic sulfide in the low wear case (Hexadecane plus DBDS in nitrogen). Author

24 COMPOSITE MATERIALS

Includes laminates.

N79-31347* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ALKALI-METAL SILICATE BINDERS AND METHODS OF MANUFACTURE Patent
John B. Schutt, inventor (to NASA) Issued 24 Jul. 1979 5 p Filed 21 Dec. 1977 Supersedes N78-17217 (16 - 08 p 1001)
(NASA-Case-GSC-12303-1; US-Patent-4,162,169; US-Patent-Appl-SN-862880; US-Patent-Class-106-74; US-Patent-Class-106-84) Avail: US Patent and Trademark Office CSCL 11D

A paint binder is described which uses a potassium or sodium silicate dispersion having a silicon dioxide to alkali-metal oxide mol ratio of from 4.8:1 to 6.0:1. The binder exhibits stability during both manufacture and storage. The process of making the binder is predictable and repeatable and the binder may be made with inexpensive components. The high mol ratio is achieved with the inclusion of a silicon dioxide hydrogel. The binder, which also employs a silicone, is in the final form of a hydrogel sol. Official Gazette of the U.S. Patent and Trademark Office

N79-31348*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
CONTAINMENT OF COMPOSITE FAN BLADES Final Report
C. L. Stotler and A. P. Coppa Jul. 1979 144 p ref
(Contract NAS3-20118)
(NASA-CR-159544; R79AEG197) Avail: NTIS HC A07/MF A01 CSCL 11D

A lightweight containment was developed for turbofan engine fan blades. Subscale ballistic-type tests were first run on a number of concepts. The most promising configuration was selected and further evaluated by larger scale tests in a rotating test rig. Weight savings made possible by the use of this new containment system were determined and extrapolated to a CF6-size engine. An analytical technique was also developed to predict the released blades motion when involved in the blade/casing interaction process. Initial checkout of this procedure was accomplished using several of the tests run during the program. Author

N79-31349*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EVALUATION OF SILICON CARBIDE FIBER/TITANIUM COMPOSITES
R. W. Jech and R. A. Signorelli Jul. 1979 28 p refs
(NASA-TM-79232; E-134) Avail: NTIS HC A03/MF A01 CSCL 11D

Izod impact, tensile, and modulus of elasticity were determined for silicon carbide fiber/titanium composites to evaluate their potential usefulness as substitutes for titanium alloys or stainless steel in stiffness critical applications for aircraft turbine engines. Variations in processing conditions and matrix ductility were examined to produce composites having good impact strength in both the as-fabricated condition and after air exposure at elevated temperature. The impact strengths of composites containing 36 volume percent silicon carbide (SiC) fiber in an unalloyed (A-40) titanium matrix were found to be equal to unreinforced titanium-6 aluminum-4 vanadium alloy; the tensile strengths of the composites were marginally better than the unreinforced unalloyed (A-70) matrix at elevated temperature, though not at room temperature. At room temperature the modulus of elasticity of the composites was 48 percent higher than titanium or its alloys and 40 percent higher than that of stainless steel. Author

N79-31350*# Celanese Research Co., Summit, N.J.
ULTRAFINE POLYBENZIMIDAZOLE (PBI) FIBERS Final Report, Jun. 1976 - Jun. 1979
E. C. Chenevey Jun. 1979 119 p refs
(Contract NAS3-20040)
(NASA-CR-159644) Avail: NTIS HC A06/MF A01 CSCL 11D

Mats were made from ultrafine polybenzimidazole (PBI) fibers to provide an alternate to the use of asbestos as separators in fuel cells and alkaline batteries. To minimize distortion during

mat drying, a process to provide a dry fibrid was developed. Two fibrid types were developed: one coarse, making mats for battery separators; the other fine, making low permeability matrices for fuel cells. Eventually, it was demonstrated that suitable mat fabrication techniques yielded fuel cell separators from the coarser alkaline battery fibrids. The stability of PBI mats to 45% KOH at 123 C can be increased by heat treatment at high temperatures. Weight loss data to 1000 hours exposure show the alkali resistance of the mats to be superior to that of asbestos. Author

N79-31351*# Georgia Inst. of Tech., Atlanta.
COMPARATIVE EVALUATION OF WOVEN GRAPHITE-EPOXY COMPOSITES Final Report
S. Hanagud, A. Tayebi, R. G. Clinton, Jr., and B. M. Nayak Jul. 1979 60 p refs
(Grant NsG-1352)
(NASA-CR-159001; E-16-604) Avail: NTIS HC A04/MF A01 CSCL 11D

A comparative evaluation of some of the mechanical properties of woven graphite-epoxy composites are discussed. In particular, the types of weaves and the resin contents were chosen for comparison. The types of weaves selected are plain weave, satin weave, and tridirectional weave. The composites made of the fabrics are compared to composites made from unidirectional tapes under static and fatigue loading. During static loading, acoustic emission events were monitored. Also, examinations of fracture surfaces and polished sections both away from the fracture surface, and of virgin specimens under an electron microscope are discussed. G.Y.

N79-31352*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Coll. of Engineering.
ENVIRONMENTAL EFFECTS ON ADVANCED COMPOSITES Final Progress Report, 1 Aug. 1978 - 31 Jul. 1979
J. Unnam, C. R. Houska, and S. V. N. Naidu Aug. 1979 58 p refs
(Grant NsG-1531)
(NASA-CR-162280) Avail: NTIS HC A04/MF A01 CSCL 11D

The development of titanium matrix composites for elevated temperature applications was investigated. General solutions for treating diffusion in multiphase multicomponent systems were studied. Graphite polyimide composites were characterized with respect to mechanical property degradation by moisture. R.E.S.

N79-31353*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THERMAL EXPANSION AND SWELLING OF CURED EPOXY RESIN USED IN GRAPHITE/EPOXY COMPOSITE
Michael J. Adamson Sep. 1979 35 p refs
(NASA-TM-78610; A-7919) Avail: NTIS HC A03/MF A01 CSCL 11D

The thermal expansion and swelling of resin material as influenced by variations in temperature during moisture absorption is discussed. Comparison measurements using composites constructed of graphite fibers and each of two epoxy resin matrices are included. Polymer theory relative to these findings is discussed and modifications are proposed. A.W.H.

N79-31354*# Boeing Commercial Airplane Co., Seattle, Wash.
DEVELOPMENT OF AIRCRAFT LAVATORY COMPARTMENTS WITH IMPROVED FIRE RESISTANCE CHARACTERISTICS. PHASE 2: SANDWICH PANEL RESIN SYSTEM DEVELOPMENT Final Report
R. A. Anderson, D. B. Arnold, and G. A. Johnson 1979 284 p refs
(Contract NAS2-8700)
(NASA-CR-152120; D6-46839) Avail: NTIS HC A13/MF A01 CSCL 11D

A NASA-funded program is described which aims to develop a resin system for use in the construction of lavatory wall panels, sidewall panels, and ceiling panels possessing flammability, smoke and gas emission, and toxicity (FS&T) characteristics superior to the existing epoxy resin. Candidate resins studied were phenolic, polyimide, and bismaleimide. Based on the results of a series of FS&T as well as mechanical and aesthetic property tests, a phenolic resin was chosen as the superior material. Material and process specifications covering the phenolic resin based materials were prepared and a method of rating sandwich panel performance was developed. A.R.H.

N79-31355# Army Missile Research and Development Command, Redstone Arsenal, Ala. Technology Lab.
DETERMINATION OF ELASTIC CONSTANTS FOR FLAWED AND UNFLAWED COMPOSITE TUBES USING SPECKLE INTERFEROMETRY
Terry L. Vandiver 8 Mar. 1979 158 p
(AD-A069191; DRDMI-T-79-36) Avail: NTIS HC A08/MF A01 CSCL 20/11

The objective of this work is to determine elastic constants for composite cylindrical specimens with and without flaws. Speckle interferometry was used to measure the displacements of 30 fiber reinforced, thin wall, composite pressure vessels. Small simulated spot flaws were introduced in 12 of the cylinders while 18 had no flaws. A mathematical and geometrical development is presented to determine the modulus of elasticity and Poisson's ratio for the composite cylinders. The test setup and procedure for preparing interferograms is described. The technique of speckle interferometric analysis using Young's Fringes is presented. A computer aided data reduction system used to analyze the interferograms is described. Plots were made of displacements versus scan points for the flawed and unflawed cylinders. The spot flaws were not detected from the displacement data. Circumferential stress, circumferential strain, axial strain, modulus of elasticity and Poisson's ratio were computed. This report presents a valid and efficient technique to determine elasticity constants using speckle interferometry. GRA

N79-31356# Varian Associates, San Carlos, Calif. EIMAC Div.
DEVELOPMENT OF A PYROLYTIC GRAPHITE GRID VERSION OF THE 4CW100,000E Final Technical Report, 10 Jun. 1977 - 26 Oct. 1978
Sterling G. McNees Griffiss AFB, N. Y. RADC May 1979 33 p
(Contract F30602-77-C-0084; AF Proj. 5573)
(AD-A071025; RADC-TR-79-106) Avail: NTIS HC A03/MF A01 CSCL 11/2

The purpose of this project was to evaluate pyrolytic graphite grids. Several tubes were built to the same general geometry as the 4CW100,000E. The X2097U has a pyrolytic grid and screen. The number of grid bars was increased by 50% to improve cutoff characteristics. The stem was redesigned to improve thermal cycling stability. The X2097V in addition had a high density filament which increased perveance by 30%. The tubes are physically interchangeable with the 4CW100,000E and in critical applications requiring high grid and screen dissipation and low drive voltage have superior performance. GRA

N79-31357# Naval Weapons Center, China Lake, Calif.
THERMAL CHARACTERISTICS OF 3501-6/AS AND 5208/T300 GRAPHITE EPOXY COMPOSITES Research Report, Feb. - Sep. 1978
Robert F. Kubin May 1979 24 p
(AD-A071067; NWC-TP-6104) Avail: NTIS HC A02/MF A01 CSCL 11/4

The thermal characteristics of two graphite epoxy composites for use as aircraft structural components have been investigated. The activation energies and heats of reaction for pyrolysis of the composites were found to be 19.7 kcal/mole and -18.4 cal/g for 3501-6/AS and 25.0 kcal/mole and -20.4 cal/g for 5208/T300, respectively. The kinetic parameters enable prediction of thermal degradation at flight temperatures. In fire fighting, bulk material temperatures must be reduced well below 300 C to prevent continuation of exothermic pyrolysis reactions. It was also found that differential scanning calorimetry provides a more sensitive test of composite cure than reflectance infrared measurements. GRA

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics*.

N79-31358*# General Electric Co., Cincinnati, Ohio.
LEAN, PREMIXED-PREVAPORIZED (LPP) COMBUSTOR CONCEPTUAL DESIGN STUDY Final Report
R. A. Dickman, W. J. Dodds, and E. E. Ekstedt May 1979 152 p refs
(Contract NAS3-21255)
(NASA-CR-159629; R79AEG376) Avail: NTIS HC A08/MF A01 CSCL 21B

Four combustion systems were designed and sized for the energy efficient engine. A fifth combustor was desiged for the cycle and envelope of the twin-spool, high bypass ratio, high pressure ratio turbofan engine. Emission levels, combustion performance, life, and reliability assessments were made for these five combustion systems. Results of these design studies indicate that cruise NOx emission can be reduced by the use of lean, premixed-prevaporaized combustion and airflow modulation.
Author

N79-31359*# National Aeronautics and Space Administration, Washington, D. C.
INDUCED IR-ABSORPTION SPECTRUM OF GASEOUS NITROGEN
M. O. Bulanin, P. V. Granskiy, and M. V. Tonkov Aug. 1979 9 p refs Transl. into ENGLISH of Indutsirovannyy Spektr IK-Pogloshcheniya Gazoobraznogo Azota, Russian report, 1979 p 1-6 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prepared by Academy of Sciences (USSR), Moscow
(Contract NASw-3199)
(NASA-TM-75653) Avail: NTIS HC A02/MF A01 CSCL 07D

The induced infrared absorption spectrum of gaseous nitrogen was studied. The coefficient of absorption of highly pure nitrogen was utilized to ascertain spectral dependence. A.W.H.

N79-31360# Aerospace Corp., El Segundo, Calif. Chemistry and Physics Lab.
A MODELING STUDY OF VIBRATIONAL PHOTOCHEMICAL ISOTOPE ENRICHMENT
C. C. Badcock, W. C. Hwang, and Jeanne F. Kalsch 29 Sep. 1978 63 p refs
(ATR-78(8127)-2) Avail: NTIS HC A04/MF A01

Chemical kinetic modeling studies of vibrational photochemical isotope enrichment were performed on two systems: Model 1, H79Br(H81Br) + Cl2 and, Model (2), H37Cl(H35Cl) + Br. Pulsed laser excitation was modeled to the first excited vibrational levels of both HC1 isotopes in Model 2. The effects on enrichment of varying the external parameters (pressure, laser intensity) and the internal parameters (rate constants for V-V exchange and excited-state reactions) were examined. Studies of these prototype systems indicate that a favorable reaction for enrichment, with isotopically-specific excitation and a significantly accelerated vibrationally-excited-state reaction should have the following properties: the reaction from v = 0 should be only moderately exoergic, and the most favorable coreactant should be a polyatomic species, such as alkyl radical. Author

N79-31361*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE CHEMISTRY OF SODIUM CHLORIDE INVOLVEMENT IN PROCESSES RELATED TO HOT CORROSION
Carl A. Stearns, Fred J. Kohl, and George C. Fryburg 1979 32 p refs Presented at the Conf. on Advanced Materials for Alternate Fuel Capable Directly Fired Heat Engines, Castine, Maine 30 Jul. - 3 Aug. 1979
(NASA-TM-79251; E-161) Avail: NTIS HC A03/MF A01 CSCL 07D

Thermodynamic and mass transport calculations, and laboratory experiments elucidating the behavior of sodium chloride in combustion environments, in the deposition process, and in reactions with certain oxides on the surfaces of superalloys are summarized. It was found that some of the ingested salt is separated out of the air stream by the compressor. However, sodium chloride does pass from the compressor to the combustor where numerous chemical reactions take place. Here some of the salt is vaporized to yield gaseous sodium chloride molecules. Hydrogen and oxygen atoms present in the combustion products react with some sodium chloride to yield other gaseous species such as sodium, and a fraction of the salt remains as particulates. Both the gas phase and condensed sodium chloride can lead to sodium sulfate formtion by various routes, all of which involve reaction with sulfur oxides and oxygen. In addition to contributing to the formation of sodium sulfate, the sodium chloride can contribute to corrosion directly. K.L.

N79-31362# National Bureau of Standards, Washington, D. C. Natl. Engineering Lab.
RADIATION-INDUCED ACOUSTIC CAVITATION: THRESHOLD VERSUS TEMPERATURE FOR SOME LIQUIDS Final Report, 30 Mar. 1978 - 30 Mar. 1979
Martin Greenspan and Carl E. Tschiegg 10 May 1979 54 p refs
(Contract N00014-78-F-0007)
(AD-A070029; NBSIR-79-1753) Avail: NTIS HC A04/MF A01 CSCL 07/4

Neutron thresholds at various temperatures were measured for methanol, ethanol, 1-propanol, 2-propanol, n-pentane, diethyl ether, fluorocarbon 113 and fluorocarbon 11, and fission thresholds were similarly measured for water, 1-propanol and 2-propanol. The work was done in 1969, but not reported then. It is presented here. A copy of a paper in which it was shown, among other things, that reproducible data on acoustic cavitation could be got by the substitution of nuclei of cavitation produced by ionizing radiation for those highly variable ones which occur naturally and often adventitiously. GRA

N79-31363# Oak Ridge National Lab., Tenn.
ENHANCED OIL RECOVERY CHEMICALS FROM RENEWABLE WOOD RESOURCES
W. N. Grune, A. L. Compere, W. L. Griffith, and J. M. Crenshaw Apr. 1979 69 p refs
(Contract W-7405-eng-26)
(ORNL-5525) Avail: NTIS HC A04/MF A01

Processes which produce useful materials from pulp and paper wastewater streams are surveyed. Emphasis is placed on chemical recovery processes, particularly production of micellar flooding chemicals to be used in advanced petroleum recovery techniques. It is indicated that production of industrial chemicals from a renewable, continuously harvested resource (wood pulp wastewater streams) may be a viable method to decrease U.S. dependence on foreign oil producers, to decrease cost of advanced petroleum recovery techniques through the synthesis of low cost chemicals, and to decrease accumulation of pollutable industrial wastes. J.M.S.

N79-31364# Brookhaven National Lab., Upton, N. Y.
FeTi METHANATION CATALYST
James R. Lynch, Len D. Spaulding, and Richard S. Sapienza Jun. 1978 12 p refs Presented at Am. Chem. Soc. Meeting, Miami, Fla., 10-15 Sep. 1978
(Contract EY-76-C-02-0016)
(BNL-24477; Conf-780902-1) Avail: NTIS HC A02/MF A01

The intermetallic compound FeTi was found to catalyze the reduction of CO and CO2 to methane by hydrogen. The CO reduction yielded traces of ethane as did CO2, in addition, CO2 reduction yielded small amounts of methanol. The appearance of CH4 was linear with time for both CO and CO2 and the rate of CO2 reduction was faster than that observed for CO. The product distribution and rate data lend support to and are discussed in terms of the proposed oxide theory for Fischer-Tropsch and related synthesis. DOE

N79-31365# Princeton Univ., N. J.
DETAILED COMBUSTION STUDIES FOR STRATIFIED CHARGE ROTARY ENGINES Final Report, 1 Apr. 1976 - 30 Sep. 1978

R. L. Steinberger and F. V. Bracco Sep. 1978 24 p refs
(Contract EY-76-S-02-2943)
(COO-2943-1) Avail: NTIS HC A02/MF A01

Research was performed to aid in the development of a stratified charge rotary engine by experimentally implementing and testing concepts for optimal charge stratification. A rotary engine test facility was built. This facility included an RC1-60 rotary engine which was coupled to a GE 60 hp dynamometer, the external wiring of which had to be mostly reconstructed. Separate rotor lubrication and cooling systems and engine housing cooling systems were designed and built. Intake and exhaust systems were planned and constructed. A fuel injection system was chosen, purchased, and installed. Once these systems were all installed and operating, engine test data was taken to compare with data taken under similar conditions and found to be in reasonable agreement. DOE

N79-31366# California Univ., Livermore. Lawrence Livermore Lab.
COMPLETE SYSTEM FOR PORTABLE GAMMA SPECTROSCOPY
D. A. Fuess 15 Nov. 1978 106 p refs
(Contract W-7405-eng-48)
(UCRL-52611) Avail: NTIS HC A06/MF A01

A system built around the Computing Gamma Spectrometer (PSA) LEA 74-008 is described. The software primarily supports high-resolution gamma-ray spectroscopy using either a high-purity intrinsic germanium detector (HPGe) or a lithium-drifted germanium detector (Ge(Li)). DOE

N79-31367# Oak Ridge National Lab., Tenn.
REMOVAL OF ORGANIC MATERIAL FROM RECYCLE VITRIC ACID BY OZONE
W. E. Clark and W. B. Howerton Apr. 1979 27 p refs
(Contract W-7405-eng-26)
(ORNL/TM-6672) Avail: NTIS HC A03/MF A01

Organic compounds can be removed from recycle nitric acid by ozonation. In the absence of catalysts the removal of acetic acid, one of the most resistant of the aliphatic species, was found to be slower than its removal from distilled water under similar conditions. Silver ion (Ag (+)) was the most effective of the catalysts tested for removal of acetic acid from nitric acid by ozonation. Other, less efficient, catalysts include Pd(2+) Mn(2+), Fe(3+), and silica gel. DOE

N79-31368# California Univ., Berkeley. Lawrence Berkeley Lab.
CHEMICAL REDUCTION OF REFRACTORY OXIDES BY ATOMIC HYDROGEN
D. Dooley, M. Balooch, and D. R. Olander Nov. 1978 6 p refs Presented at ANS Meeting, Wash., D. C., 12 Nov. 1978
(Contract W-7405-eng-48)
(LBL-8548; Conf-781105-102) Avail: NTIS HC A02/MF A01

The chemical reduction of UO2 and Al2O3 by atomic hydrogen was studied. Results of the UO2/H investigation indicates that reduction of UO2 by atomic hydrogen proceeds by the production of water vapor and hypostoichiometric urania. Water vapor and aluminum metal are formed in the Al2O3/H system. The relative ease which UO2 is reduced by atomic hydrogen compared with Al2O3 is due to two factors. The first is related to the thermochemistry of the reactions. The second factor which favors efficient reduction of UO2 but not of Al2O3 is the oxygen diffusivity. DOE

N79-31369# California Univ., Berkeley. Lawrence Berkeley Lab.
FUNDAMENTAL FLAME-SPEED MEASUREMENTS IN COMBUSTION GASES CONTAINING CF3Br
D. J. Parks, N. J. Alvares, and D. G. Beason 23 Mar. 1979 27 p Presented at the Spring meeting on western states section and the Combustion Inst., Provo, Utah, 23-24 Apr. 1979
(Contract W-7405-eng-48)
(UCRL-82181; Conf-790434-2) Avail: NTIS HC A03/MF A01

An acoustically tuned flame tube was used to measure fundamental flame speed and flammability envelopes of premixed propane/air and methane/air that contain minute amounts of CF3Br. The flat propagation boundaries produced by this tube allow one to measure fundamental flame speed directly without having to make complicated velocity adjustments because of irregular flame shape. Flame speed decreases exponentially with the concentration of CF3Br regardless of the equivalence ratio, and more CF3Br is needed to make fuel-rich mixtures inert than to make fuel-lean mixtures inert. Consequently, one can attain significantly lower flame speed on the fuel-rich side of the flammability envelope. The implications of these data for gross extinguishment mechanisms indicate CF3Br combines with free hydrogen radicals in competition with oxygen to interfere with chain-branching propagation. DOE

N79-31370# Societe des Accumulateurs Fixes et de Traction, Romainville (France). Dept. Accumulaters.
THE DEFINITION OF THE PROCESS OF ELECTROCHEMICAL IMPREGNATION OF NICKEL ELECTRODES Final Report [DEFINITION DE L'IMPREGNATION ELECTROCHIMIQUE DES ELECTRODES DE NICKEL]
P. Antoine 1978 176 p refs In FRENCH
(Contract ESTEC-3000/76-NL-HP(SC))
(DI/SAS-112/78-PA/CM; ESA-CR(P)-1182) Avail: NTIS HC A09/MF A01

Electrochemical impregnation was studied during a series of experiments designed to define the optimal conditions for the fabrication of dimensionally stable cell anodes of Ni-H2 and Ni-Cd systems. The influence of various parameters, such as current and duration of electrolysis, temperature and acidity of the chemical bath, the concentrations of Ni and Co as well as the use of ethanol, was determined. Results show that the electrochemical impregnation process as defined is industrially feasible and it is suggested that Ni-H2 and Ni-Cd type electrodes be produced in sufficient quantity to further evaluate their performance characteristics. Author (ESA)

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N79-31371# National Aeronautical Establishment, Ottawa (Ontario).
FORGING BEHAVIOUR OF SUPERALLOY COMPACTS AND COMPOSITES
A. Kandeil, J. P. Immarigeon, and W. Wallace Feb. 1978 46 p refs
(NRC-16543; LR-595) Avail: NTIS HC A03/MF A01

The forging behavior of hot isostatically pressed nickel-base super-alloy (Mar M200) compacts, reinforced with 40% volume fraction of tungsten wires, was examined and compared with that of the non-reinforced alloy matrix. Subscale forging blanks, 10 x 10 x 15 mm high for the composite and 9.65 mm high by 6.35 mm in diameter for the matrix, were deformed by means of isothermal compression. Under identical working conditions, peak flow stresses for the composite specimens are up to four times those for the non-reinforced matrix. Furthermore, the strain rate sensitivity of the composite is approximately half that of the superplastic matrix. A rationalization of these differences is presented. Forming limit criteria for the composite are examined. A model is considered which predicts an upper bound forming limit beyond which severe damage is introduced into the composite. In the present case, the maximum strain achievable is predicted and shown to be aproximately 0.34. At lower strains, formability is shown to be further limited by void nucleation at the tensile poles of the wires, normal to the loading direction. A.R.H.

N79-31372*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SURVEY OF ION PLATING SOURCES
Talivaldis Spalvins 1979 25 p refs Presented at 26th Natl. Vacuum Symp., N. Y., 2-5 Oct. 1979; sponsored by the Am. Vacuum Soc.
(NASA-TM-79269; E-188) Avail: NTIS HC A02/MF A01 CSCL 11F

Based on the type of evaporation source, gaseous media

and mode of transport, the following is discussed: resistance, electron beam, sputtering, reactive and ion beam evaporation. Ionization efficiencies and ion energies in the glow discharge determine the percentage of atoms which are ionized under typical ion plating conditions. The plating flux consists of a small number of energetic ions and a large number of energetic neutrals. The energy distribution ranges from thermal energies up to a maximum energy of the discharge. The various reaction mechanisms which contribute to the exceptionally strong adherence - formation of a graded sustrate/coating interface are not fully understood, however the controlling factors are evaluated. The influence of process variables on the nucleation and growth characteristics are illustrated in terms of morphological changes which affect the mechanical and tribological properties of the coating. M.M.M.

N79-31373# Canada Inst. for Scientific and Technical Information, Ottawa (Ontario).

HYDROGEN IN IRON AND STEEL

Ernst Riecke 1979 33 p refs Transl. into ENGLISH from Arch. Eisenhuttenwes (West Germany), v. 49, no. 11, 1978 p 509-520

(ISSN-0077-5606; NRC/CNR-TT-1948) Avail: NTIS HC A03/MF A01

For the explanation of the fracture mechanisms, the pressure theory and the adsorption decohesion theory was suggested. Each of these theories is justified and capable to describe a partial aspect of the fracture phenomena. None of the theories pretends to be perfect and generally valid. Since hydrogen is effective in a various and complex manner, all phenomena cannot be described by one theory. M.M.M.

N79-31374# Auburn Univ., Ala. Southeastern Center for Electrical Engineering Education.

A CONSTITUTIVE MODEL FOR THE DEFORMATION INDUCED ANISOTROPIC FLOW OF METALS Interim Report, Aug. - Oct. 1978

D. C. Stouffer (Cincinnati Univ.) and S. R. Bodner (Technion - Israel Inst. of Tech.) Wright-Patterson AFB, Ohio AFML Mar. 1979 24 p refs

(Contract F33615-77-C-5003; AF Proj. 2307)

(AD-A069954; AFML-TR-79-4015) Avail: NTIS HC A02/MF A01 CSCL 20/11

A mathematical framework is established for the equations governing inelastic deformation under multidimensional stress state and the associated evolution equations of the internal state variables. The formulation is based on a generalization of the Prandtl- Reuss flow law. For the evolution equations it is assumed that part of the rate of change in the inelastic state variables is isotropic and the remaining part varies according to the sign and orientation of the current rate of deformation vector. This leads to a minimum of 12 components of the internal state tensor to represent the inelastic plastic flow. In this manner, both initial and load history induced plastic anisotropy can be modeled. A specific set of equations for anisotropic plastic flow is developed consistent with the inelastic state variables.

Author (GRA)

N79-31375# Northwestern Univ., Evanston, Ill. Dept. of Materials Science.

STRESS ANALYSIS FROM POWDER DIFFRACTION PATTERNS

Jerome B. Cohen, Heiner Doelle, and Michael R. James (Rockwell International Science Center) 14 May 1979 40 p refs Presented at the Symp. on Accuracy in Powder Diffraction, Gaithersburg, Md., 11-15 Jun. 1979; sponsored by NBS

(Contract N00014-75-C-0580)

(AD-A069824; TR-23) Avail: NTIS HC A03/MF A01 CSCL 11/6

A brief review of the method of measuring residual stresses in polycrystalline materials with X-rays is given. The effect of counting statistics on precision is discussed as well as factors that affect accuracy. Beam penetration, stress gradients, and the form of the stress tensor can each seriously affect accuracy, if traditional methods are employed, and practical procedures to deal with such situations are outlined. GRA

N79-31376# Brown Univ., Providence, R. I. Engineering Materials Research Lab.

CREEP OF 2618 ALUMINUM UNDER STEP STRESS CHANGES PREDICTED BY A VISCOUS-VISCOELASTIC MODEL

James S. Lai and William N. Findley Apr. 1979 29 p refs (Grant DAAG29-78-G-0185)

(AD-A070355; EMRL-71; ARO-15508.1-E) Avail: NTIS HC A03/MF A01 CSCL 11/6

Nonlinear constitutive equations are developed and used to predict from constant stress data the creep behavior of 2618 Aluminum at 200 c 392 F for tension or torsion stresses under varying stress history including step-up, step-down, and reloading stress changes. The strain in the constitutive equation employed includes the following components: linear elastic, time-independent plastic, nonlinear time-dependent recoverable viscoelastic, nonlinear time-dependent nonrecoverable viscous positive, and nonlinear time-dependent nonrecoverable viscous negative. The modified superposition principle, derived from the multiple integral representation, and strain hardening theory were used to represent the recoverable and nonrecoverable components, respectively, of the time-dependent strain in the constitutive equations. GRA

N79-31377# Boeing Co., Seattle, Wash.

PRELIMINARY EVALUATION OF HYDROFOIL BASE METALS AND COATING SYSTEMS

P. S. Jacobsen and D. D. Miller Feb. 1973 60 p refs

(AD-A070171; Rept-173-255) Avail: NTIS HC A04/MF A01 CSCL 11/6

The candidate base metals were reviewed for the hydrofoil application. Four materials were chosen for this evaluation. They were 17-4 PH and 15-5 PH stainless steels, HY130 steel and Ti6 Al-20B1 Ta-1 Mo titanium. Fracture and corrosion fatigue data are being obtained on these materials as part of an on-going program and the available data is reported. Since the HY-type alloys require a corrosion protective coating, a screening evaluation of coating systems has been conducted. Four coating systems have been selected for further testing including their effect on the corrosion fatigue and fracture properties of the HY-130. Details of the screening tests are reported. GRA

N79-31378# National Materials Advisory Board, Washington, D. C.

ION IMPLANTATION AS A NEW SURFACE TREATMENT TECHNOLOGY Final Report

1979 52 p refs

(Contract MDA903-78-C-0038)

(AD-A070379; NMAB-349) Avail: NTIS HC A04/MF A01 CSCL 11/6

Ion implantation is a new technique presently used commercially in the semiconductor industry for treating the surface of metals that has shown a potential for producing orders of magnitude improvement in wear and corrosion applications. Improvements in the surfaces of optical elements and novel optical components may also be possible through use of the process. The objective of the present study was to assess the value of ion implantation in applications of interest to the Department of Defense and the National Aeronautics and Space Administration. Because the application of ion implantation to metallurgy is very new, little definitive information is available. The general feeling of this committee is that the results reported are promising enough to justify a vigorous pursuit of the knowledge that will permit a full evaluation of the more promising possibilities, and perhaps, a realization of the application of ion implantation to improve components. GRA

N79-31379# University of Southern California, Los Angeles. Dept. of Materials Science.

PHYSICAL METALLURGY OF BETA TITANIUM ALLOYS Final Report, 1 Aug. 1974 - 31 Mar. 1979

Stephen M. Copley 30 May 1979 42 p

(Grant AF-AFOSR-2766-75; AF Proj. 2306)

(AD-A070042; AFOSR-79-0722TR) Avail: NTIS HC A03/MF A01 CSCL 11/6

Titanium alloy beta phases, PE61102F, WUAFOSR2306A127 Phase eqilibria have been determined for Ti-V, Mo, Cr system with Cr additions up to 10 wt pct. The results indicate composition

ranges where the equilibrium phase is beta, as-cast alloys are ductile enough to be cold worked and where the tendency to lose ductility during heat treatment due to oxygen segregation is minimal. An investigation of the effect of adding Al and Si to beta alloys indicates that yield stress and Young's modulus are increased while density and ductility are decreased. It appears that Al increases the ductile brittle transition temperature. GRA

N79-31380# Oak Ridge National Lab., Tenn. Engineering Technology Div.
EVALUATION OF THE EFFECTIVENESS OF SELECTED CORROSION INHIBITORS FOR PROTECTION OF PRESTRESSING STEELS IN PCPVs
D. J. Naus Mar. 1979 62 p ref
(Contract W-7405-eng-26)
(ORNL/TM-6779) Avail: NTIS HC A04/MF A01

The corrosion protection of prestressing steel by portland cement-based grout in the presence of sulfide, nitrate, and chloride ion environments was evaluated. Results were compared to those obtained from selected, commercially available petroleum microcrystalline waxes (petrolatums) compounds with organic corrosion inhibitors. A review of literature and a laboratory study were conducted. Conclusions indicate that: (1) sulfide, nitrate, and chloride salts must be excluded from prestressing materials; (2) prestressing materials must be continuously protected from inimical environments; (3) the effectiveness of the protection provided by both the organic- and cement-based corrosion inhibitors is reduced unless the steel is completely covered; and (4) both cement- and organic-based corrosion inhibitors completely protect prestressing materials when properly applied. DOE

N79-31381# Oak Ridge National Lab., Tenn.
PRECIPITATION RESPONSE OF 20%-COLD-WORKED TYPE 316 STAINLESS STEEL TO SIMULATED FUSION IRRADIATION
P. J. Maziasz 1979 5 p refs Presented at the 1st Topical Meeting on Fusion Reactor Mater., Miami Beach, Fla., 29 Jan. 1979
(Contract W-7405-eng-26)
(CONF-790125-31) Avail: NTIS HC A02/MF A01

The precipitation response of 20%-cold-worked type 316 stainless steel was examined after irradiation in HFIR at 380-600 C, after irradiation in EBR-11 at 500 C, and after thermal aging at 600 to 750 C. Eta phase forms during exposure to all environments, and it constitutes a major portion of the precipitation response. It is normally reported in 20% cold-worked type 316 stainless steel. Qualitatively, for eta phase, M23C6, Laves, sigma and chi, the precipitate phases appear at similar temperatures after HFIR, EBR-11, or thermal exposure. There are, however, some differences in relative amounts of phases, size, and distribution when compared among the various environments. Eta phase is the only carbide-type phase observed after irradiation in HFIR from 380 to 550 C. The large cavities associated with it at 380 C contribute significantly to swelling. Precipitate re-solution and re-precipitation of massive particles of sigma, M23C6 and chi are observed after recrystallization in HFIR. DOE

N79-31382# Oak Ridge National Lab., Tenn.
INFLUENCE OF HELIUM ON MICROSTRUCTURAL EVOLUTION IN AN ION-IRRADIATION LOW-SWELLING STAINLESS STEEL
E. A. Kenik 1979 5 p refs Presented at the 1st Topical Meeting on Fusion Reactor Mater., Miami Beach, Fla., 29 Jan. 1979
(Contract W-7405-eng-26)
(CONF-790125-30) Avail: NTIS HC A02/MF A01

The evolution of damage in a low-swelling stainless steel under ion irradiation is examined. The influence of the presence of helium and its mode of injection upon dislocation evolution, phase instability, and swelling are investigated. Comparison of the response of the low-swelling alloy with that of a high-swelling alloy leads to some conclusions on the origin of the observed swelling resistance. The dislocation loop evolution can be modified by the presence of helium during the nucleation stage. The influence of helium on phase instability arises from its modification of the loop substructure at which solute segregation occurs. Phase instability is not a sufficient condition for void formation in the swelling resistant alloy. Titanium getters soluble gases which aid void nucleation, while silicon may influence swelling by a trapping mechanism. DOE

N79-31383# Sandia Labs., Livermore, Calif.
FORMATION OF PROTECTIVE LAYERS ON ALLOYS DEVELOPED FOR USE IN COAL GASIFICATION ENVIRONMENTS Final Report
R. W. Bradshaw, R. E. Stoltz, and D. R. Adolphson 30 Sep. 1978 100 p refs
(Contract EY-76-C-04-0789)
(SAND-78-8277) Avail: NTIS HC A05/MF A01

Improvement in high temperature compatibility of iron and nickel based alloys in coal gasification environments was investigated. The addition of a few weight percent titanium to 310 stainless steel and Ni-30Cr was very effective in both isothermal and cyclic high temperature atmospheres which simulated the corrosion potential existing in the 1800 F high Btu coal gasification process. Alloy fabrication practices were unaffected and standard welding processes did not alter mechanical behavior or compatibility. Further work on 310 revealed that the as-received mechanical properties were unaffected by the Ti additions; that the normal levels of impurities and minimum specification level of chromium did not alter the beneficial effects of Ti; and that the mechanism by which Ti improves compatibility is linked to microstructural or chemical changes in the surface CR2O3 coating. DOE

N79-31384# Oak Ridge National Lab., Tenn.
ELECTRON-BEAM WELDING OF THORIUM-DOPED IRIDIUM ALLOY SHEETS
S. A. David, C. T. Liu, and J. D. Hudson Apr. 1979 22 p refs
(Contract W-7405-eng-26)
(ORNL/TM-6711) Avail: NTIS HC A02/MF A01

Modified iridium alloys containing 100 ppm Th were found to be very susceptible to hot cracking during gas tungsten arc and electron beam welding. However, the electron beam welding process showed greater promise of success in welding these alloys, in particular Ir-0.3% W doped with 200 ppm Th and 50 ppm Al. The weldability of this particular alloy was extremely sensitive to the welding parameters, such as beam focus condition and welding speed, and the resulting fusion zone structure. At low speed successful electron beam welds were made over a narrow range of beam focus conditions. However, at high speeds successful welds were made over an extended range of focus conditions. The fusion zone grain structure is a strong function of welding speed and focus condition, as well. In the welds that showed hot cracking, a region of positive segregation of thorium was identified at the fusion boundary. DOE

N79-31385# Westinghouse Electric Corp., Pittsburgh, Pa.
SOME MECHANISTIC OBSERVATIONS ON THE CRACK GROWTH CHARACTERISTICS OF PRESSURE VESSEL AND PIPING STEELS IN PWR ENVIRONMENT
W. H. Bamford and D. M. Moon 1979 25 p refs Presented at NACE/Corrosion 1979 Meeting, Atlanta, Ga., 12 Mar. 1979
(Contract W-7405-eng-26)
(CONF-790313-4) Avail: NTIS HC A02/MF A01

The fatigue crack growth behavior of A533B and A508 pressure vessel steel and AISI Types 304 and 316 steels used in reactor coolant piping were studied in a pressurized water reactor environment at 288 C (550 F). While none of the materials showed evidence of static crack growth in the environment, the ferritic steels did show an enhanced fatigue crack growth rate at test frequencies of five cycles per minute and lower. Based on fractographic examinations the enhanced growth rate is not the result of environmentally induced intergranular or cleavage modes of crack propagation. Instead, striation spacing measurements agreed with the macroscopic crack growth rate, demonstrating a time dependent environmental interaction which introduces a frequency dependent enhancement of the mechanically developed striations. Crack growth experiments confirmed the absence of any superimposed contribution of static crack growth components. Fatigue crack growth tests, conducted in an environment of hydrogen sulfide gas to establish the contribution of hydrogen embrittlement are described. DOE

N79-31386# International Nickel Co., Inc., Suffern, N. Y. Inco Research and Development Center.
EVALUATION OF HIGH CHROMIUM OVERLAYS TO PROTECT LESS ALLOYED SUBSTRATES FROM CORROSION IN A COAL GASIFICATION ATMOSPHERE Quarterly Report, 1 Dec. 1977 - 28 Feb. 1978
Edward P. Sadowski 1978 31 p
(Contract EF-77-C-01-2621)
(FE-2621-2) Avail: NTIS HC A03/MF A01

The development and evaluation of weld deposited overlays to provide resistance to corrosion in coal gasification atmospheres is reported. Weld deposition techniques and procedures for three weld processes are described. The weld processes are gas tungsten arc with hot wire, gas metal arc, and submerged arc. Single and double overlays were tested and evaluated. The tests consisted of hardness surveys, bend and tensile tests, bulk chemical analysis of the overlay, and microprobe analysis for the distribution of the major alloying elements from the outside edge of the overlay through the thickness of the base plate. A.W.H.

N79-31387# California Univ., Livermore. Lawrence Livermore Lab.
CORRELATION BETWEEN ACOUSTIC EMISSION AND MICROSTRUCTURE IN ALUMINUM ALLOYS
R. Bunch, M. A. Hamstad, and A. K. Mukherjee 6 Dec. 1978 10 p refs Presented at ASNT Spring Conf., San Diego, Calif., 2-5 Apr. 1979
(Contract W-7405-eng-48)
(UCRL-81879; Conf-790409-2) Avail: NTIS HC A02/MF A01

Acoustic emission (AE) monitoring during tension or compression testing is shown to be effective and sensitive in sorting out aluminum lots that have undesirable inclusion distributions. This technique is possible because the main source of AE in these alloys is inclusion particle fracture or decohesion or both. The technique is used as an alternative to fracture toughness tests and tensile tests for high strength alloys. A.W.H.

N79-31388# Sandia Labs., Albuquerque, N. Mex.
ROLE OF SURFACE CONTAMINANTS IN THE DEFORMATION WELDING OF GOLD TO THICK AND THIN FILMS
J. L. Jellison and J. A. Wagner 1979 10 p refs Presented at the 29th Electron. Components Conf., Cherry Hill, N.J., 14 May 1979
(Contract EY-76-C-04-0789)
(SAND-79-0352C; Conf-790506-2) Avail: NTIS HC A02/MF A01

The role of organic surface contaminants in the deformation welding of gold to thick and thin film conductors was investigated, employing shear tests to determine the strength of ball bonds. As was observed earlier for gold thin films, organic surface films play a dominant role in the deformation welding of gold to gold thick films. Gold thick films were found to be more tolerant to organic surface films than film gold. The contaminants evaluated (beeswax, halocarbon wax, and petrolatum) all degraded the weldability of gold more than atmospheric contaminantation. The gold-platinum thick films required higher temperatures than the gold metallizations for thermocompression welding. DOE

N79-31389# Mound Lab., Miamisburg, Ohio.
STUDY ON THE DIFFUSION OF HYDROGEN INTO TRANSITION METAL HYDRIDES AND THEIR ALLOYS
O. T. Malutchkov, J. J. Lileeva, and A. A. Tchertkov 23 Mar. 1979 12 p Transl. into ENGLISH from Proc. Intern. Congr. Hydrogen in Metals, France, 1972 p 261-263 Presented at the Intern. Congr. on Hydrogen in Metals, Paris, 29 Apr. 1972
(Contract DE-AC04-76-DP00053)
(MLM-2600-TR; Conf-720571-2-Trans) Avail: NTIS HC A02/MF A01

The activation energy alloy concentration dependences in hydrogen diffusion in the temperature range from -170 to +200 C were determined from narrowing of proton magnetic resonance (PMR) spectra in the hydrides of alloy systems TiV, TiNb, and TiMo. From the measurements of intensities of PMR spectra it was found that hydrogen is redistributed between tetrahedral and octahedral sites of the fcc hydride lattice, depending on the concentration of the second component of the alloy and on temperature. The change in hydrogen diffusion activation energy as a function of the concentration of the second alloy component was shown to be a linear combination of relative changes of lattice parameters and metallic ion effective charge. DOE

N79-31390# Bendix Corp., Kansas City, Mo.
DEPOSITION OF ALUMINUM-COPPER ALLOY ON LAMINATED POLYIMIDE SUBSTRATES FROM A RF INDUCTION SOURCE
G. J. Hale Apr. 1979 31 p refs Presented at the Intern. Conf. on Met. Coatings, San Diego, Calif., 23 Apr. 1979
(Contract EY-76-C-04-0613)
(BDX-613-2173; Conf-790442-6) Avail: NTIS HC A03/MF A01

A physical vapor deposition process with a RF micrometer induction vapor source was developed to deposit 11.2-micrometers Al-Cu alloy on polyimide laminate substrates. The average thickness uniformity (standard deviation/average thickness) of the deposit acquired by a beta backscatter technique was approximately 1% for these deposits. The A1-0.3 wt % Cu vapor charge results in a Cu content in the deposit of 0.12 wt %. The Cu shows no preferential deposition pattern, as related to the surface of the laminate and its dispersion throughout the deposit. The resistivity of the Al-Cu deposits is 3.0 micro-ohms cm and is stable from one deposition run to another. Also, the resistivity was not related to the geometry of the domed substrate. The density of the 11.2-micrometer-thick Al-Cu film was within 1% of theoretical, and its adhesion to the polyimide exceeds that required for post-deposition operations and handling. The deposited films exhibited a specular reflectance above 90% with a 632.8 nm wave length source and a grain size of 0.6 micrometer throughout the deposit. DOE

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N79-31391*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MECHANICAL AND CHEMICAL EFFECTS OF ION-TEXTURING BIOMEDICAL POLYMERS
A. J. Weigand and M. A. Cenkus 1979 29 p refs Presented at 32nd Ann. Conf. of Engr. in Med. and Biol., Denver, 6-10 Oct. 1979; sponsored by Alliance for Engr. in Med.
(NASA-TM-79245; E-152) Avail: NTIS HC A03/MF A01 CSCL 07C

To determine whether sputter etching may provide substantial polymer surface texturing with insignificant changes in chemical and mechanical properties, an 8 cm beam diameter, electron bombardment, argon ion source was used to sputter etch (ion-texture process) nine biomedical polymers. The materials included silicone rubber, 32% carbon impregnated polyolefin, polyoxymethylene, polytetrafluoroethylene, ultrahigh molecular weight (UHMW) polyethylene, UHMW polyethylene with carbon fibers (10%), and several polyurethanes (bioelectric, segmented, and cross linked). Ion textured microtensile specimens of each material except UHMW polyethylene and UHMW polyethylene with 10% carbon fibers were used to determine the effect of ion texturing on tensile properties. Scanning electron microscopy was used to determine surface morphology changes, and electron spectroscopy for chemical analysis was used to analyze the near surface chemical changes that result from ion texturing. Ion energies of 500 eV with beam current densities ranging from 0.08 to 0.19 mA/sq cm were used to ion texture the various materials. Standard microtensile specimens of seven polymers were exposed to a saline environment for 24 hours prior to and during the tensile testing. The surface chemical changes resulting from sputter etching are minimal in spite of the often significant changes in the surface morphology. A.W.H.

N79-31392*# Army Inst. of Dental Research, Washington, D. C.
EFFECT OF TIN-PLATING UPON ADHESIVE BONDING OF

POLYCARBOXYLATE CEMENTS Technical Report, Feb. - Sep. 1978
L. Lorton, B. K. Moore, J. W. Morse, and R. W. Phillips 22 May 1979 6 p refs
(AD-A071037) Avail: NTIS HC A02/MF A01 CSCL 11/1

It has been suggested that tin-plated gold surfaces would more easily be adhered to by polycarboxylate cement. Controlled tin plating studies were carried out to test this hypothesis. It was found that scrupulous cleaning of the gold surface produced adhesive bonding that equalled bond strength to tin plated surface. Cement failures were cohesive rather than adhesive suggesting that bond strengths approach cohesive strength of cement. GRA

N79-31393# Vermont Univ., Burlington. Dept. of Chemistry.
A STUDY OF THE VARIABLE-TEMPERATURE MAGNETIC SUSCEPTIBILITY OF TWO Ti(III) OXALATE COMPLEXES
James T. Wrobleski and David B. Brown 11 Jun. 1979 17 p refs
(Contract N00014-75-C-0756)
(AD-A070438; TR-17) Avail: NTIS HC A02/MF A01 CSCL 07/4

Variable-temperature magnetic susceptibility data have been obtained for polycrystalline samples of two Ti III oxalate complexes, T12 C2043 H206.4 H2O and T12 C2043 H20 5. The bridging oxalate dianion in the former complex a seven-coordinate dimer with D 5 H symmetry provides an effective path for magnetic exchange between the two Ti III ions as evidenced b for T12 C2043 H2O 5 were fit to a distorted-octahedral, single-ion, spin-orbit coupling magnetic model with delta (ground term splitting) = 300/cm and k (orbital reduction factor) = 0.7 with gamma = 155/cm. Room temperature optical spectra of Ti2(C2O4)3(H2O)6.4H2O and Ti2(C2O4)3(H2O)5 were recorded and the resulting band assignments are consistent with D5h and distorted octahedral ligand field symmetries, respectively. GRA

N79-31394# Vermont Univ., Burlington. Dept. of Chemistry.
SYNTHESIS, ELECTRICAL CONDUCTIVITY, AND MAGNETISM OF A NEW MOLECULAR METAL K2(Ni(1,2-DITHIOOXALATE)2)I SUB 1.0
James T. Wrobleski and David B. Brown 11 Jun. 1979 12 p refs
(Contract N00014-75-C-0756)
(AD-A070441; TR-16) Avail: NTIS HC A02/MF A01 CSCL 07/3

Mixed-valence, linear-chain polymers which possess relatively high electrical conductivity have been prepared from square-planar transition-metal complexes which contain C, N, O, or S donor groups. GRA

N79-31395# United Technologies Research Center, East Hartford, Conn.
INVESTIGATION OF SILICON-NITROGEN CERAMICS FOR GAS TURBINES Final Report, Sep. 1977 - Oct. 1978
George K. Layden 27 Jan. 1979 110 p refs
(Contract N62269-77-C-0248)
(AD-A070469; UTRC/R79-914147-4; NADC-77063-30) Avail: NTIS HC A06/MF A01 CSCL 11/2

Ceramic bodies having compositions in the Beta', Beta'-15 R, and Beta'-O' phase fields in the S13 N4 - Si O2- Al2 O3-Si O2 System which are prepared using fine grained constituents cannot be sintered to high density, since little or no liquid forms during normal firing schedules. Beta'- X phase bodies, however, sinter to near theoretical density as a result of the presence of a liquid phase under equilibrium conditions at temperatures above about 1750 C. One such body, composition 20e/O Al, 20e/OC, was characterized in terms of room temperature and 1370 C flexural strength, 1370 C creep, and 1000 and 1400 C static oxidation behavior, and Mach 0.8 flame erosion at 1270 C. Attempts were made to supply a transient liquid to effect sintering of Beta,-15 R, and Beta'O' Bodies by controlling particle size distributions of different constituent phases. There was evidence that, in fact, transient liquids were induced at temperatures above 1750 C, but solid phase particle bridging effects prevented gross shrinkage. It seems highly likely that the application of pressure at temperatures to such formulations could yield the desired result--Dense Beta' based materials that contain neither residual glass nor X phase. GRA

N79-31396# Illinois Univ. at Urbana-Champaign. Dept. of Ceramic Engineering.
DENSIFICATION OF PZT CERAMICS WITH V205 ADDITIVE
D. E. Wittmer and R. C. Buchanan Jan. 1979 24 p refs
(Contract N00014-78-C-0279)
(AD-A070803; TR-1) Avail: NTIS HC A02/MF A01 CSCL 11/2

Additions of V2O5 from 0.1 to 8.0 w/o to a coprecipitated Pb(Zr.53 Ti.47) O3 ceramic promoted rapid densification below 1025 C, eliminating the need for PbO atmosphere control. Dielectric properties were found to be dependent on the amount of V2O5 added and on the microstructure developed, but were comparable to reported values for this PZT composition for additions of V2O5 < or = 1.5 W/O. The indicated densification mechanism is one of activated sintering catalyzed by generation of oxygen defects on decomposition of the V2O5. GRA

N79-31397# Columbia Univ., New York. Dept. of Chemistry.
ORGANOMETALLIC COMPOUNDS Final Report, 1 Jun. 1969 - 31 Mar. 1978
Thomas J. Katz 14 May 1979 79 p refs
(Grants DA-ARO(D)-31-124-G1119;
DA-ARO(D)-31-124-73-G122)
(AD-A070315; ARO-7908.6-C; ARO-11300.1-C) Avail: NTIS HC A05/MF A01 CSCL 11/9

Studies are described aimed at testing whether novel polymeric chemical structures can be synthesized in which hydrocarbon rings and metal atoms alternate. A number of appropriate hydrocarbon dianions have been synthesized for the first time, as have a number of molecules containing two metal atoms sandwiched between a pair of planar hydrocarbons. Structures like this were not known before the start of the work. Some properties of these novel materials have been measured. The first attempts have been made to implement two schemes designed to prevent the combination of a hydrocarbon dianion and a metal halide from giving a dimeric structure rather than a polymer. One scheme involves the preparation of helical hydrocarbons capped by five-membered rings, and ways to make such materials are developed. The other involves the preparation of a hydrocarbon trianion with a three-fold axis of symmetry and three terminal five-membered rings. The first example, the trindene trianion, is prepared. GRA

N79-31398# Army Mobility Equipment Research and Development Command, Fort Belvoir, Va.
EFFECTIVENESS OF STANDARD TEST FLUIDS IN EVALUATING THE FUEL RESISTANCE OF ELASTOMERS Technical Report, Jul. 1973 - Sep. 1978
Paul E. Gatza, Paul Touchet, and Floyd P. Powell Apr. 1979 53 p
(DA Proj. 1T1-62105-AH-84; DA Proj. 1T0-61101-A-91A)
(AD-A070271; MERACOM-2273) Avail: NTIS HC A04/MF A01 CSCL 11/10

The fuel resistance of representative elastometric compounds exposed in commercial leaded, low-leaded, and unleaded gasolines is investigated and related to the aromatic content of these fuels. Similar data are obtained for exposure in standard ASTM and military test fuels. The efficacy of these test fuels is discussed and an alternative nonbenzene containing test fluid of 40 percent aromatic content is proposed for inclusion in ASTM and military standards. GRA

N79-31399# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
INVESTIGATION OF A DEPLOYABLE POLYURETHANE FOAM GROUND IMPACT ATTENUATION SYSTEM FOR AEROSPACE VEHICLES. VOLUME 1: FIAS TESTS NUMBERS 1 THROUGH 48 Final Technical Report, Jun. 1975 - Nov. 1977
Stephen R. Mehaffie Jan. 1979 127 p refs
(AF Proj. 1964)
(AD-A070077; AFFDL-TR-78-145-Vol-1) Avail: NTIS HC A07/MF A01 CSCL 01/3

An investigation was conducted to determine the feasibility of an advanced deployable impact attenuation system for use with aerospace vehicles. The operational parameters of the AQM-34 V RPV were used as a basis for the determination of attenuator feasibility. A series of 91 tests were conducted to demonstrate the attenuation performance. The conclusion was that a deployable polyurethane foam impact attenuation system was eminently feasible for use in a premeditated recovery system such as used with the AQM-34 V vehicle. Volume I of this report documents Tests numbers 1 through 48, and Volume II documents Tests numbers 49 through 91. GRA

N79-31400# Massachusetts Univ., Amherst. Dept. of Chemistry.

FLEXIBLE METAL CHELATE POLYMERS THROUGH NONRIGID METAL CENTERS Final Report, 5 Apr. 1976 - 4 Apr. 1979

Ronald D. Archer 30 May 1979 11 p

(Grant DAAG29-76-G-0192)

(AD-A070364; ARO-13583.7-CX) Avail: NTIS HC A02/MF A01 CSCL 11/9

Flexible polymers from conjugated organic ligands and nonrigid metal centers have been synthesized and have been evaluated for thermal stability. A tungsten polymer, bis 5,7-dichloro-8-quinolinolato -5,8-quinoxalinediolato-tungsten IV with number average molecular weight near 40,000 to 50,000 Daltons has been synthesized from the quinoxalinedione and a tungsten II intermediate. Several other polymers, monomers, and intermediates have also been investigated, where the metals range from molybdenum and tungsten to zirconium and the eight-coordinate centers are all N404 ligand donor sets, and with the seven-coordinate intermediate possessing carbon, phosphorus, nitrogen, oxygen, and/or chlorine donors. The molybdenum and tungsten species appear to have energy-transfer potential. GRA

N79-31401# Southwest Research Inst., San Antonio, Tex.

COMPRESSIVE STRENGTH AND INDENTATION DAMAGE IN CERAMIC MATERIALS Progress Report, 31 May 1978 - 31 May 1979

James Lankford, Jr. and David L. Davidson Jun. 1979 54 p refs

(Contract N00014-75-C-0668; NR Proj. 032-553)

(AD-A070256) Avail: NTIS HC A04/MF A01 CSCL 11/2

The threshold loads and crack sizes for indentation cracking were investigated for a number of ceramics using scanning electron microscopy and acoustic emission. It was found that the cracking behavior could be predicted, using a fracture mechanics/dimensional analysis approach modified to take into account the stress field at an elastic-plastic indentation. Selected area electron channeling was used to characterize the extent of subsurface damage produced in ceramics during grinding and polishing operations. It was found that polishing damage depths can be correlated using a simple model based on a sliding elastic-plastic indenter. Finally, the effect of temperature and strain rate upon material removal and cracking threshold was analyzed, using recent experimental compressive strength and crack growth measurements as inputs to current predictive models. The results are shown to have surprising implications with regard to dynamic, high temperature indentation particle impact. GRA

N79-31402# California Univ., Livermore. Lawrence Livermore Lab.

DEVELOPMENT OF ALTERNATE SILICONE POTTING COMPOUNDS. VOLUME 4: DEVELOPMENT OF A SUBSTITUTE FOR DOW CORNING AEROSPACE SEALANT DC 93-120 RESIN CURED WITH DC 93-122 CURING AGENT

W. E. Cady and A. T. Buckner 11 Jan. 1979 24 p refs

(Contract W-7405-eng-48)

(UCRL-52434-Vol-4) Avail: NTIS HC A02/MF A01

A substitute for Dow Corning DC 93-120 silicone potting resin cured with DC 93-122 silicon curing agent formulated from Dielectric Gel Q3-6527, accelerator QCF3-6559, and DC 1107 fluid is described. The substitute is much lower in viscosity than the material it replaces, but it is equally fast setting, friable, and weak as measured by butt-tensile strength to aluminum. Evaluations are described for two lots of Q3, three lots of DC 1107, and two lots of accelerator. The 1107 and accelerator are minor components whose lot-to-lot variations are not significant. The only significant variable is the reaction rate of the Q3. Because Q3 connot be activated by the platinum-containing accelerator alone to a gel time of 15 min, the active hydrogen concentrate DC 1107 is needed. Using both accelerator and 1107 in proportions to minimize 1107 is preferred because this decreases the likelihood of porosity in the cured potting compound. DOE

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N79-31403*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

THERMOPHYSICAL PROPERTY DATA: WHO NEEDS THEM?

R. C. Hendricks 1979 27 p refs Proposed for presentation at the Winter Ann. Meeting of the ASME, N. Y., 2-7 Dec. 1979

(NASA-TM-79241; E-149) Avail: NTIS HC A03/MF A01 CSCL 07D

Specific examples are cited to illustrate the universal needs and demands for thermophysical property data. Applications of the principle of similarity in fluid mechanics and heat transfer and extensions of the principle to fluid mixtures are discussed. It becomes quite clear that no matter how eloquent theories (or experiments) in fluid mechanics or heat transfer are, results of their application can be no more accurate than the thermophysical properties required to transform these theories into practice - or in the case of an experiment, to reduce the data. Present day projects take place on such a scale that the need for international standards groups and mutual cooperation is evident. Author

N79-31404# Committee on Government Operations (U. S. House).

BIOMASS CONVERSION

Washington GPO 1978 163 p refs Hearing before a Subcomm. of the Comm. on Government Operations, 95th Congr., 2d Sess., 14 Apr. 1978

(GPO-32-317) Avail: Comm. on Government Operations

Testimony was given and arguments were heard on the economics and the technical viability of producing alcohol fuels and chemical feedstocks from agricultural products and wastes and urban organic wastes. M.M.M.

N79-31405*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

COMPARISON OF THE PROPERTIES OF SOME SYNTHETIC CRUDES WITH PETROLEUM CRUDES

Albert C. Antoine Jul. 1979 31 p refs

(NASA-TM-79220; E-115) Avail: NTIS HC A03/MF A01 CSCL 21D

Physical properties and chemical compositions of six synthetic crudes were determined. The results were compared to those of typical petroleum crudes, with the interest being the feasibility of making jet fuels from oil shale and coal syncrudes. The specific gravity, viscosity, and pour point were measured, showing that these crudes would be described as heavier rather than lighter crudes. The boiling range distribution of the crudes was determined by distillation and by gas chromatography. In addition, gel permeation chromatograms were obtained, giving a unique molecular weight distribution profile for each crude. Analyses for carbon, hydrogen, nitrogen and sulfur concentrations were performed, as well as for hydrocarbon group type and trace element concentrations. It was found that the range in concentration of vanadium, an element whose presence in turbine fuels is of major concern, was lower than that of petroleum crudes. Sodium and potassium, other elements of concern, were present in comparatively high concentrations. Author

N79-31406# National Technical Information Service, Springfield, Va.
HYDROGEN PRODUCTION, VOLUME 1. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - 1977
Diane M. Cavagnaro Jun. 1979 233 p
(NTIS/PS-79/0540/9) Avail: NTIS HC $28.00/MF $28.00 CSCL 21D

This bibliography contains citations on the manufacturing of hydrogen by electrolysis, coal gasification, and other techniques. They cover both experimental research and production on the industrial scale. Although most of the citations are on production methods, economic studies are also included. (This updated bibliography contains 227 abstracts, none of which are new entries to the previous edition.) GRA

N79-31407# National Technical Information Service, Springfield, Va.
HYDROGEN PRODUCTION, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1978 - May 1979
Diane M. Cavagnaro Jun. 1979 150 p Supersedes NTIS/PS-75/379; NTIS/PS-78/0514; NTIS/PS-77/0492; NTIS/PS-76/0459
(NTIS/PS-79/0541/7; NTIS/PS-75/379; NTIS/PS-78/0514; NTIS/PS-77/0492; NTIS/PS-76/0459) Avail: NTIS HC $28.00/MF $28.00 CSCL 21D

The cited reports include studies on the manufacturing of hydrogen by electrolysis, coal gasification and other techniques. They cover both experimental research and production on the industrial scale. Although most of the reports are on production methods, economic studies are also included. The updated bibliography contains 144 abstracts, 49 of which are new entries to the previous edition. GRA

N79-31408# Civil and Environmental Engineering Development Office, Tyndall AFB, Fla.
JP-4 FUEL STORAGE EMISSIONS Final Report, Sep. 1977 - Dec. 1978
Thomas B. Stauffer Dec. 1978 34 p refs
(AD-A069280; CEEDO-TR-79-05) Avail: NTIS HC A03/MF A01 CSCL 20/4

JP-4 vapors from underground fixed roof storage tanks were analyzed for hydrocarbon concentration by Gas Chromatography using a Flame Ionization Detector. Results are compared with predictions based on American Petroleum Institute correlations. Since Air Force tanks are normally refilled within 24 hours of emptying, only turnover times of 24 hours and less were considered. It was found that within 24 hours tank air reached only 75-85 percent of saturation for JP-4. At turnover times of 7.5 hours and less a marked layering of vapor concentration could be measured in the expelled air. Actual mass emissions are less than predicted by equations because of the rapid turnover and consequential reduction in vapor concentration. Data presented provide a basis for calculating a rough estimate for hydrocarbon mass emitted based on fuel storage temperature. Actual mass emissions measured during the study varied from 0.6 to 1.5 lb/1000 gal of JP-4 transferred while the fuel temperature ranged from 51 F to 79 F. GRA

N79-31409# Civil and Environmental Engineering Development Office, Tyndall AFB, Fla.
HYDRAZINE DISPOSAL BY BURNING Interim Report, Sep. - Oct. 1978
Thomas B. Stauffer and Melvin D. Fannon Dec. 1978 11 p refs
(AF Proj. 1900)
(AD-A069468; CEEDO-TR-78-55) Avail: NTIS HC A02/MF A01 CSCL 21/9

Burning was evaluated as a technique for the disposal of hydrazine and aqueous hydrazine solutions. Samples were collected above the burning pools and analyzed for hydrazine concentration to determine if concentrations exceeded the personnel exposure threshold limit value of 0.13 mg/cu m. Results indicate that neat fuel burns rapidly leaving little residual hydrazine, but ignition of aqueous solutions becomes progressively more difficult as the water concentration increases. Some air samples collected above the burning hydrazine solutions exceed NIOSH personnel exposure limits, however, high destruction efficiency, rapid destruction, and potential cost savings make burning an attractive alternative to chemical neutralization under controlled conditions as discussed in this report. GRA

N79-31410# Institute of Gas Technology, Chicago, Ill.
RESEARCH AND DEVELOPMENT OF RAPID HYDROGENATION FOR COAL CONVERSION TO SYNTHETIC MOTOR FUELS (RISER CRACKING OF COAL) Quarterly Report, 1 Jul. - 30 Sep. 1978
D. A. Duncan, Justin L. Beeson, and R. Donald Oberle Dec. 1978 34 p refs
(Contract EX-76-C-01-2307)
(FE-2307-42; QR-2) Avail: NTIS HC A03/MF A01

Methods for handling caking coals were explored including the use of dry diluents, extractive solvents, and additives. Both silica sand and devolatilized char were successfully used as dry diluents, but processing was inefficient. Slurrying with a solvent carrier comprised of 20% weight naphthalene, 40% by weight toluene, and 40% by weight phenol is in the evaluation stage, as is the use of additives which are used at the level of 10% by weight additive with 90% by weight coal. One of the most promising systems is coal treated in water with calcium hydroxide with subsequent evaporation of the water to obtain dry solids for feeding. A low pressure simulator of a PD combustor section was built and operated; there does not appear to be any critical relationship between the mainstream velocity and the entering oxygen velocity, allowing considerable latitude in sizing the air/oxygen injection needle. For temperature changes of 300 F, the use of ceramic shields does not appear to be necessary. DOE

N79-31411# SRI International Corp., Menlo Park, Calif.
HOMOGENEOUS CATALYTIC HYDROCRACKING PROCESSES FOR CONVERSION OF COAL TO LIQUID FUELS: BASIC AND EXPLORATORY RESEARCH Quarterly Report, 16 Sep. - 15 Dec. 1978
12 Mar. 1979 33 p refs
(Contract EX-76-C-01-2202)
(FE-2202-39) Avail: NTIS HC A03/MF A01

The role of base in both coal and lignite liquefaction in the CO-H2O system was explored as well as the catalysis of coal conversion in tetralin by KOH, and the effects of LiA1H4 pretreatment of coal on its subsequent upgradability. Results suggest that, although KOH is important for obtaining high conversion yields from bituminous coal in CO-H2O, its importance is largely indirect, serving to leach transition metals from the autoclave. Lignite conversion is little affected by the presence or absence of KOH in the system. The addition of KOH and H2O to tetralin had no effect on bituminous coal conversion: the action of tetralin was not catalyzed. Pretreatment of a bituminous coal with LiA1H4 to reduce any quinones present had a small but measurably favorable effect on its solubility compared with that of untreated coal. This difference remained even after heating under vacuum, but disappeared upon heating in H2 or tetralin. DOE

N79-31412# Westinghouse Electric Corp., Pittsburgh, Pa. Advanced Energy Systems Div.
ECONOMIC COMPARISON OF HYDROGEN PRODUCTION USING SULFURIC ACID ELECTROLYSIS AND SULFUR CYCLE WATER DECOMPOSITION Final Report
G. H. Farbman, B. R. Krasicki, C. C. Hardman, S. S. Lin, and G. H. Parker Jun. 1978 134 p refs
(EPRI Proj. 1086-2)
(EPRI-EM-789) Avail: NTIS HC A07/MF A01

An evaluation of the relative economics of hydrogen production using two advanced techniques were performed. The hydrogen production systems considered were the Westinghouse Sulfur Cycle Water Decomposition System and a water electrolysis system employing a sulfuric acid electrolyte. The former is a hybrid system in which hydrogen is produced in an electrolyzer which uses sulfur dioxide to depolarize the anode. The electrolyte is sulfuric acid. Development and demonstration efforts have shown that extremely low cell voltages can be achieved. The second system uses a similar sulfuric acid electrolyte technology in water electrolysis cells. The economic evaluation of hydrogen production, based on a 1976 cost basis and assuming a developed technology for both hydrogen production systems and the VHTRs, indicated that the hybrid Sulfur Cycle could generate hydrogen

for a total cost approximately 6 to 7% less than the cost from the sulfuric acid electrolysis plant. DOE

N79-31413# Midwest Research Inst., Golden, Colo.
PROCESS DESIGNS AND COST ESTIMATES FOR A MEDIUM BTU GASIFICATION PLANT USING A WOOD FEEDSTOCK
Raymond E. Desrosiers Feb. 1979 61 p refs
(Contract EG-77-C-01-4042)
(SERI/TR-33-151) Avail: NTIS HC A04/MF A01

A gasification plant to effect the conversion of wood to medium Btu gas described. The cost of the processing steps common to all gasification schemes and specific research areas are examined. Capital investment statements for three plant sizes are included along with manufacturing costs for each of these at three feedstock prices. The design incorporates a front end handling system, package cryogenic oxygen plant, the gasifier, a gas cleaning train consisting of a spray scrubber, ionizing wet scrubber, and condenser, and a wastewater treatment facility including a cooling tower and a package activated sludge unit. Cost figures for package units were obtained from suppliers and used for the oxygen and wastewater treatment plants. The gasifier is fed with wood chips at 20% moisture (wet basis). For each pound of wood, 0.32 lb of oxygen are required, and 1.11 lb of gas are produced. DOE

N79-31414# Braun (C. F.) and Co., Alhambra, Calif.
COMBINED SHIFT-METHANATION PROCESSES Final Report
N. G. Kertamus Sep. 1978 32 p
(Contract EX-76-C-01-2240)
(FE-2240-97) Avail: NTIS HC A03/MF A01

The potential advantage of combining shift and methanation reactions is the reduction of two gas processing operations employing separate catalysts and reactors into a single operation with only one catalyst. Multiple reactors are required for both the combined shift methanation and separate shift methanation processes. The basis for economic comparison is the lowest total of capital cost plus four years of operating costs. The results show that the separate shift and methanation process is clearly superior economically to the three combined shift and methanation processes originally proposed by the licensors. Because of the high cost of energy, the relative economics of these processes is strongly influenced by energy recovery. The major factor in favor of the separate shift and methanation processes is that it recovers more useful energy than the combined shift methanation processes. The relative rankings are shown. DOE

N79-31415# Utah Univ., Salt Lake City. Dept. of Mining and Fuels Engineering.
APPLIED RESEARCH AND EVALUATION OF PROCESS CONCEPTS FOR LIQUEFACTION AND GASIFICATION OF WESTERN COALS Quarterly Progress Report, Apr. - Jun. 1978
W. H. Wiser Jul. 1978 49 p
(Contract EX-76-C-01-2006)
(FE-2006-12) Avail: NTIS HC A03/MF A01

Sixteen research projects in the gasification or liquefaction of coal, catalysis, or related research are reviewed. Fundamental principles involved and the properties of coal and coal conversion products are discussed. DOE

N79-31416# Bechtel Corp., San Francisco, Calif.
ANALYSIS OF COAL HYDROGASIFICATION PROCESSES Final Report
M. Epstein, T. P. Chen, and M. A. Ghaly Aug. 1978 166 p refs
(Contract EF-77-A-01-2565)
(FE-2565-14) Avail: NTIS HC A08/MF A01

The operability potential and scaleup feasibility of coal hydrogasification processes were investigated. The entrained downflow reactor systems operate at temperatures up to 2,000 F and pressures up to 3,000 psi. Reactor product is primarily methane. Bituminous, subbituminous, and lignite coal hydrogasification and hydropyrolysis data for each process were collected and analyzed. Semiempirical correlations for predicting overall carbon conversion efficiency and carbon selectivity to gaseous products were fitted to the data. A conceptual design of a full-scale hydrogasification reactor was generated on the basis of the subbituminous coal data gathered in the various reactors, together with the predictive reactor performance models fitted to the data. DOE

N79-31417# Braun (C. F.) and Co., Alhambra, Calif.
CONSIDERATIONS IN SIZING COAL GASIFICATION PLANTS Final Report
R. E. Musgrove and D. L. Maifield 1978 68 p refs
(Contract EX-76-C-01-2240)
(FE-2240-40) Avail: NTIS HC A04/MF A01

The economy of scale favors the largest practical size plant. The size constraints of practicality for coal gasification at this time are principally technological, through under some circumstances coal availability, market demand, labor conditions capital availability, and particularly regulatory policy may have some influence on the size of a plant at a particular location. The 250 billion Btu per day size plant seems to meet all of the constraints fairly well, though the specific size is not mandatory. Many plants of that size could be built in the areas we studied. The increased cost of gas produced from plants smaller than 250 billion Btu per day practically dictates the alternative of transporting coal and water over reasonable distances to a 250 billion Btu per day or larger size plant. Building separate smaller plants at the site of the coal deposits should only be considered under unusual circumstances of local demand or terrain which would make transportation of resources significantly less attractive. DOE

N79-31418# Pittsburgh Univ., Pa. Dept. of Chemical and Petroleum Engineering.
ADDITION OF DEVOLATILIZATION EQUATIONS TO SYNTHANE COMPUTERIZED MATHEMATICAL MODEL Quarterly Report, 15 Sep. - 15 Dec. 1978
J. T. Cobb, Jr. Jan. 1979 10 p refs
(Contract EW-78-S-22-0277)
(COO-0277-1) Avail: NTIS HC A02/MF A01

Six approaches to devolatilization modeling were reviewed. Two were further evaluated: the Vand-type model of Anthony and Howard and the diffusion model of Russel et al. The first of these treats particles under kinetic control only. The second includes some mass transfer control along with kinetic control. Behavior of particles in the synthane process appears to be in the transition region between kinetic and mass transfer control. DOE

N79-31419# Oklahoma State Univ., Stillwater. School of Chemical Engineering.
DEVELOPMENT OF A PROCESS FOR PRODUCING AN ASHLESS, LOW-SULFUR FUEL FROM COAL. VOLUME 4: PRODUCT STUDIES. PART 10: COAL LIQUIDS CATALYST WORK PERFORMED AT OKLAHOMA STATE UNIVERSITY. SOLVENT REFINED COAL (SRC) PROCESS Final Interim Report, 17 Jun. 1970 - 16 Jun. 1975
Billy L. Crynes Jan. 1979 79 p refs Prepared in cooperation with Pittsburg and Midway Coal Mining Co., Shawnee Mission, Kans.
(Contract EX-76-C-01-0496)
(FE-0496-T10-Vol-4-Pt-10; FIR-19; Res/Develop-53-Vol-4-Pt-10) Avail: NTIS HC A05/MF A01

The effects of catalyst support pore properties on sulfur and nitrogen removal from certain coal liquids were assessed. The research was divided into three broad areas: (1) equipment and analytical operability; (2) catalyst assessment over variables of space time, temperature, and pressure; and (3) 200 hour catalyst activity tests at fixed conditions. DOE

N79-31420# Los Alamos Scientific Lab., N. Mex.
THERMAL RESPONSE OF EXPLOSIVES SUBJECTED TO EXTERNAL HEATING
A. Popolato, J. J. Ruminer, A. S. Vigil, N. K. Kernodle, and D. L. Jaeger Feb. 1979 34 p refs
(Contract W-7405-eng-36)
(LA-7667-MS; AFATL-TR-78-95) Avail: NTIS HC A03/MF A01

A series of unconfined one dimensional heating experiments in slab geometry was conducted with TNT, Comp. B, plastic-bonded HMX, TATB, DATB, and NQ. The explosive samples

were heated on one surface at heating rates between 10 and 25 C/min. The experimentally determined times and temperatures to ignition were reproduced computationally, with one exception, by solving a one dimensional heat-conduction equation containing a zero-order reaction energy source term and a time-dependent temperature boundary condition. The one exception was plastic-bonded NQ. Unconfined plastic-bonded NQ did not ignite under the experimental conditions used. The heat-transfer mechanism in molten TNT, as expected, was convective; and for molten Comp. B, conductive. A reactive heat-transfer program, EXPLO, was written that is capable of solving the convective transfer mode and accepting mixtures of explosives reacting with first-order kinetics. DOE

N79-31421# Brookhaven National Lab., Upton, N. Y.
FUSION REACTORS FOR SYNTHETIC FUELS
J. R. Powell 1979 5 p Presented at the ANS Ann. Meeting, Atlanta, 3-6 Jun. 1979
(Contract EY-76-C-02-0016)
(BNL-25634; Conf-790602-39) Avail: NTIS HC A02/MF A01

Some of the types of processes now being considered for synthetic fuels production from fusion energy, together with an example of each type are listed. The process efficiency is defined as the chemical energy in the generated hydrogen (at the higher heating value (HHV)) divided by the total fusion energy release, including alpha particles and secondary neutron reactions in the blanket. Except where specifically noted, both high and low temperature blanket heats are counted as part of total fusion energy release. DOE

N79-31422# Midwest Research Inst., Golden, Colo.
PHOTOBIOLOGICAL PRODUCTION OF HYDROGEN: A SOLAR ENERGY CONVERSION OPTION
P. Weaver, S. Lien, and M. Seibert Jan. 1979 109 p refs
(Contract EG-77-C-01-4042)
(SERI/TR-33-122) Avail: NTIS HC A06/MF A01

The history of photobiological hydrogen production from its discovery in relatively pure cultures during the early 1930s to the present is reviewed with emphasis on hydrogen production by phototrophic organisms (and their components) which occurs at the expense of light energy and electron-donating substrates. Among the topics included is an overview of hydrogen metabolism in photosynthetic bacteria, eucaryotic algae, and cyanobacteria (blue-green algae). The primary enzyme systems, including hydrogenase and nitrogenase, are discussed along with the manner in which they are coupled to electron transport and the primary photochemistry of photosynthesis. A number of in vivo and in vitro photobiological hydrogen evolving schemes including photosynthetic bacterial, green algal, cyanobacterial, two-stage, and cell-free systems are examined. Specific technical problem areas that currently limit the yield and duration of many of the systems and research that might lead to progress in these specific areas are discussed. DOE

N79-31423# Department of Energy, Bartlesville, Okla. Energy Technology Center.
ETHANOL/GASOLINE BLENDS AS AUTOMOTIVE FUEL
J. R. Allsup and D. B. Eccleston May 1979 17 p refs
(BETC/RI-79/2) Avail: NTIS HC A02/MF A01

Vehicle tests were conducted to determine the influence of ethanol in a 10% ethanol/90% gasoline fuel mixture on fuel economy, regulated and unregulated exhaust emissions, exhaust hydrocarbon distribution, and road octane quality. Volumetric fuel economy was shown to be slightly decreased while energy economy was slightly increased using the ethanol/gasoline blend compared to gasoline. When compared to the base gasoline, the use of the ethanol/gasoline blend caused no deleterious effects upon regulated emissions at ambient temperatures from 20 to 75 F; at 100 F ambient there were minor increases in emissions using the ethanol/ gasoline blend. The ethanol/gasoline blend generally had either no effect on or reduced all unburned hydrocarbon components except at the 100 F test conditions compared to gasoline. Road octane quality was shown to be increased by the use of the ethanol/gasoline blend compared to gasoline. DOE

N79-31424# Wayne State Univ., Detroit, Mich.
FLAME PROPAGATION, AUTOIGNITION AND COMBUSTION IN ALCOHOL-PETROLEUM-AIR MIXTURES AND OTHER ALTERNATIVE FUELS Progress Report, 1 Aug. 1977 - 31 Jul. 1978
N. A. Henein Jun. 1978 11 p refs
(Contract EC-77-S-02-4486)
(COO-4486-3; PR-3) Avail: NTIS HC A02/MF A01

The combustion characteristics of alcohols, alcohol-petroleum blends, and coal and shale oil derivatives in both diesel and gas turbine engines were investigated. Running tests were conducted on three research engines to determine the (1) motor octane number of the fuel; (2) flame speed; (3) flammability limits; (4) cycle-to-cycle variations; (5) emissions; (6) performance parameters, such as power and economy; (7) ignition delay; and (8) cetane number of the fuel. Because the present cetane scale is unsuitable for rating the low ignition quality fuels and many alternative fuels, a modified scale was developed. The flame speed was calculated and correlated with different fuel properties and engine operating parameters, the effect of turbulence was determined, and the ignition delay was correlated with fuel and air properties. The global activation energy for the autoignition reaction was characterized and correlated with the cetane number of the fuel. DOE

N79-31425# Sandia Labs., Albuquerque, N. Mex.
ANALYSIS OF AMIDE COMPLEX IMPURITY IN CP EXPLOSIVE BY INFRARED SPECTROSCOPY
R. G. Jungst and P. K. Peterson Aug. 1978 28 p refs
(Contract EY-76-C-04-0789)
(SAND-78-1395) Avail: NTIS HC A03/MF A01

Samples were run differentially against high purity CP or by special sample preparation involving deuteration of the ammonia in order to remove partially interfering infrared absorbances. Calibration was completed in the 1 to 15% mole fraction amide complex concentration region for differentially measured samples, and in the 0.5 to 10% region for deuterated samples. The lower values in the ranges are the approximate detection limits without employing scale expansions or signal averaging. A statistical analysis indicates that the 95% confidence limits for a single future measurement using these calibrations at the 2% amide complex level are + or - 0.7% for the differential and 0.35% for the deuteration method. The concentration range studied is appropriate for analysis of typical production batches of CP, and the methods discussed offer improvements in accuracy and detection limit (deuteration procedure) or savings in time (differential procedure) when compared to analysis by thin layer chromatography. DOE

N79-31426# Sandia Labs., Albuquerque, N. Mex.
QUALITATIVE COMPARISON OF TATB AND PBX 9404 BEHAVIOR WHEN PREHEATED AND IGNITED UNDER CONFINEMENT
D. O. Lee and A. B. Donaldson Aug. 1978 16 p ref
(Contract EY-76-C-04-0789)
(SAND-78-0561) Avail: NTIS HC A02/MF A01

The results of experiments in which TATB (X-0219) and PBX 9404 specimens were heated and then ignited by a resistance heating element are presented. The insensitive TATB did not detonate and ceased to burn when the heating element was turned off, whereas the PBX 9404 appeared to undergo a high order detonation. DOE

N79-31427# Mound Lab., Miamisburg, Ohio.
EFFECT OF POWDER COMPACTION VARIABLES ON THE PERFORMANCE OF A PYROTECHNICAL IGNITER
A. C. Munger, N. J. Seubert, and J. R. Brinkman 1978 14 p refs Presented at the 6th Pyrotechnics Seminar, Estes Park, Colo., 17 Jul. 1978
(Contract EY-76-C-04-0053)
(MLM-2553(OP); Conf-780706-17) Avail: NTIS HC A02/MF A01

The compaction of the pyrotechnic powder against a bridgewire interface can be effected by the powder characteristics, environment, surface finish and configuration of the compact holder and the loading process. Some of these parameters were evaluated and the effect determined on the bridgewire-powder interface as well as the initiation performance. DOE

N79-31428# Mound Lab., Miamisburg, Ohio.
DETERMINATION OF THERMAL DIFFUSIVITY OF PYROTECHNIC MATERIALS
Don E. Etter, D. R. Kaser, and L. J. Wittenberg 1978 13 p refs Presented at the 6th Pyrotechnics Seminar, Estes Park, Colo., 17 Jul. 1978
(Contract EY-76-C-04-0053)
(MLM-2552(OP); Conf-780706) Avail: NTIS HC A02/MF A01

Thermal diffusivity, along with density and specific heat, are used to calculate thermal conductivity. A literature search revealed the relatively simple method commonly known as the flash-diffusivity method. This method, with appropriate modification to accent pyrotechnic materials at elevated temperatures, was selected to study thermal diffusivity of pyrotechnic materials.
J.M.S.

N79-31429# Garrett Energy Research and Engineering Co., Ojai, Calif.
INVESTIGATION OF WOODY BIOMASS SPECIES FOR FUEL PRODUCTION IN WARM CLIMATE, NON-AGRICULTURAL LAND IRRIGATED BY BRACKISH OR SALINE WATER Quarterly Report
Donald E. Garrett 24 Jul. 1978 5 p
(Contract ET-78-C-01-3077)
(TID-28998; QR-1) Avail: NTIS HC A02/MF A01

Survival rates of Tamarix plants in two areas of California, one in the Mojave Desert, are described. Reasons for poor survival are discussed briefly. DOE

N79-31430# Sandia Labs., Albuquerque, N. Mex.
DEVELOPMENT OF A UNIQUE PYROTECHNIC ACTUATOR
C. P. Ballard and B. R. Steele 1979 38 p Presented at the 10th Symp. on Explosives and Pyrotechnics, San Francisco, 14 Feb. 1979
(Contract EY-76-C-04-0789)
(SAND-78-1731C; Conf-790207-5) Avail: NTIS HC A03/MF A01

Design features for a pyrotechnic actuator include a non-oriented connector, an electrostatic shield for safety, an output-end seal to eliminate initial free volume, and a retaining washer to prevent movement of the pyrotechnic during exposure to high G loads and thermal cycling. Materials used include a titanium subhydride/potassium perchlorate pyrotechnic for reduced spark sensitivity and a moldable baria/lithia/silica glass ceramic insulator for economy and high pressure burst strength. The glass ceramic was formulated to have a thermal expansion coefficient which minimizes residual seal stress and permits greater actuator design flexibility. DOE

N79-31431# Pennsylvania State Univ., University Park. Coal Research Section.
REVIEW OF SOME PHYSICAL METHODS OF COAL CHARACTERIZATION, THEIR APPLICATION IN CONSTITUTION ANALYSIS AND RELEVANCE TO INDUSTRIAL UTILIZATION
A. Davis Nov. 1978 55 p refs
(Contract EX-76-C-01-2030)
(FE-2030-TR-11) Avail: NTIS HC A04/MF A01

Physical methods which are used to characterize coals are described and discussed. These include maceral and reflectance analysis, density, various tests of the plastic behavior of coals, Vickers microhardness, and Hardgrove grindability. DOE

N79-31432# Aerospace Corp., El Segundo, Calif.
UTILIZATION OF USED OIL Final Report
G. J. Mascetti and H. M. White Aug. 1978 396 p
(Contract EY-76-C-1101-003)
(ATR-78(7384)1) Avail: NTIS HC A17/MF A01

The potential impact of re-refining used automotive and industrial lubricating oils on the national petroleum consumption is assessed. The technical base for this assessment is derived from a comprehensive review of the processes utilized in re-refining used oil and those processes used to produce lube oil from crude. Existing and recently proposed processes are considered. An extensive review of processes described in the patent literature is provided. Re-refining processes are surveyed and evaluated. Process descriptions are provided, hardware is identified, and process energy and economic requirements are calculated. Factors affecting the profitability of a re-refining operation are discussed. Economic projections of the demand for lube oil and the ability to satisfy this demand from crude oil are made and the value of lube oil as a vital resource and the need for conservation are addressed. DOE

N79-31433# National Technical Information Service, Springfield, Va.
SYNTHETIC FUELS FROM MUNICIPAL, INDUSTRIAL, AND AGRICULTURAL WASTES. CITATIONS FROM THE NTIS DATA BASE Report, 1964 - Apr. 1979
Audrey S. Hundemann Jun. 1979 172 p Supersedes NTIS/PS-78/0499; NTIS/PS-77/0112; NTIS/PS-76/0795; NTIS/PS-75/655
(NTIS/PS-79/0545/8; NTIS/PS-78/0499; NTIS/PS-77/0112; NTIS/PS-76/0795; NTIS/PS-75/655) Avail: NTIS HC $28.00/MF $28.00 CSCL 21D

This bibliography contains 164 citations on the production of gaseous and liquid synthetic fuels from solid wastes. Waste products used in the syntheses including manure, sewage, paper, and wood are included. Methane is the primary fuel produced, however, the production of oils, methanol, and ethanol is also discussed. GRA

N79-31434# National Technical Information Service, Springfield, Va.
SYNTHETIC FUELS FROM MUNICIPAL, INDUSTRIAL AND AGRICULTURAL WASTES, VOLUME 1. CITATIONS FROM THE AMERICAN PETROLEUM INSTITUTE DATA BASE Report, 1975 - 1977
Audrey S. Hundemann Jun. 1979 289 p
(NTIS/PS-79/0546/6) Avail: NTIS HC $28.00/MF $28.00 CSCL 21D

This bibliography cites worldwide literature on the production of fuels from waste materials such as animal manure, wood chips, sewage sludge, urban garbage, agricultural wastes, and old automobile tires. This updated bibliography contains 283 abstracts, none of which is new to the previous edition.
GRA

N79-31435# National Technical Information Service, Springfield, Va.
SYNTHETIC FUELS FROM MUNICIPAL, INDUSTRIAL AND AGRICULTURAL WASTES, VOLUME 2. CITATIONS FROM THE AMERICAN PETROLEUM INSTITUTE DATA BASE Progress Report, 1978 - Mar. 1979
Audrey S. Hundemann Jun. 1979 63 p Supersedes NTIS/PS-78/0500 and NTIS/PS-77/0113
(NTIS/PS-79/0547/4; NTIS/PS-78/0500; NTIS/PS-77/0113) Avail: NTIS HC $28.00/MF $28.00 CSCL 21D

The bibliography cites worldwide literature on the production of fuels from waste materials, such as animal manure, wood chips, sewage sludge, urban garbage, agricultural wastes, and old automobile tires. (This updated bibliography contains 57 abstracts, all of which are new entries to the previous edition.) GRA

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N79-31436# Minnesota Univ., Minneapolis. School of Public Health.
HOSPITAL VENTILATION STANDARDS AND ENERGY CONSERVATION: A SUMMARY OF THE LITERATURE WITH CONCLUSIONS AND RECOMMENDATIONS Final Report, FY 1978
Roger L. DeRoos, Robert S. Banks, David Rainer, Jonna L. Anderson, and George S. Michaelson Sep. 1978 308 p refs Prepared for California Univ., Lawrence Berkeley Lab.
(Contract W-7405-eng-48)
(LBL-8316; EEB-Hosp-78-3) Avail: NTIS HC A14/MF A01

The basis for current hospital heating, ventilation, and air

conditioning standards were examined to determine if the standards could be relaxed based on criteria that does not compromise the health, safety, and comfort of patients and staff and that has acceptance of the health community. Principles are presented which favor a reduction of dependence on outdoor air for conrol of the unique hazards in hospitals. Control of these hazards could be managed by point source control of microenvironments. Then, ventilation air criteria would become analagous to that for other building spaces. However, it must be recognized that implementation of the presented principles requires concurrent changes in hospital operating procedures, some of which require additional research. R.E.S.

N79-31437*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ANALYTICAL MODEL OF AN ANNULAR MOMENTUM CONTROL DEVICE (AMCD) LABORATORY TEST MODEL MAGNETIC BEARING ACTUATOR
Nelson J. Groom Aug. 1979 21 p refs
(NASA-TM-80099) Avail: NTIS HC A02/MF A01 CSCL 14B

An analytical model of an Annular Momentum Control Device (AMCD) laboratory test model magnetic bearing actuator with permanent magnet fluxbiasing is presented. An AMCD consists of a spinning annular rim which is suspended by a noncontacting linear electromagnetic spin motor. The actuator is treated as a lumped-parameter electromechanical system in the development of the model. Author

N79-31438# Bechtel National, Inc., San Francisco, Calif.
CONCEPTUAL DESIGN AND COST STUDY FOR A DUAL-PURPOSE NUCLEAR-ELECTRIC REVERSE OSMOSIS SEAWATER CONVERSION PLANT
Apr. 1979 130 p refs
(Contract W-7405-eng-26)
(ORNL/TM-6821) Avail: NTIS HC A07/MF A01

A conceptual design and cost estimate for a 25 million gallon per day seawater reverse osmosis desalting plant operating at both Caribbean and Persian Gulf sites were developed. The plant would operate in conjunction with a 1000 MW(e) nuclear power plant. Four seawater membrane manufacturers were supplied with feedwater analysis and a simplified cost estimating procedure in order to recommend membrane systems which would be applicable. For both sites a two-stage system was selected for development of a conceptual cost estimate. DOE

N79-31439# California Univ., Berkeley. Lawrence Berkeley Lab.
COMPUTER DESIGN AND OPTIMIZATION OF CRYOGENIC REFRIGERATION SYSTEMS
M. A. Green, H. S. Pines, and P. A. Doyle Jun. 1978 10 p refs Presented at the 7th Intern. Conf. of Eng., London, 4-7 Jul. 1978
(Contract W-7405-eng-48)
(LBL-7934; Conf-780718-4) Avail: NTIS HC A02/MF A01

The design and optimization of a cryogenic refrigerator using the LBL computer program GEOTHM are described. This computer program has been used extensively to design and optimize geothermal power plants and power cycles of other types. GEOTHM can calculate the thermodynamics of a wide variety of cycles including refrigeration cycles. GEOTHM has an optimizer which permits single step multiparameter optimization of a thermodynamic cycle. A refrigeration cycle may be optimized for minimum cost refrigeration, or maximum thermodynamic performance using up to 55 optimizable parameters. The use of the optimizer in GEOTHM is demonstrated on two liquid nitrogen refrigeration cycles which are optimized for minimum refrigeration cost and minimum input power. DOE

N79-31440# Societe Nationale Industrielle Aerospatiale, Cannes (France). Div. Systemes Balistiques et Spatiaux.
A LIQUID HELIUM 2 CRYOSTAT FOR SPACE UTILIZATION Final Report
26 Feb. 1979 268 p Partly in FRENCH and ENGLISH Sponsored by ESA Original contains color illustrations
(Rept-959-A-CA/44; ESA-CR(P)-1216) Avail: NTIS HC A12/MF A01

A program for the development of a liquid helium 2 cryostat suitable for use in a variety of spaceborne experiments and capable of withstanding the rigors of launch and recovery is presented. Several different designs are examined, their pros and cons listed, and a detailed description of the basic configuration chosen is given. The final design has the advantages of employing already existing technologies, of being easily reusable, and of being well adapted to user requirements as it can be integrated with various instruments (superconductor magnets, supercooled telescopes, etc.). Fabrication specifications are discussed in detail, including descriptions of auxiliary hardware (tanks, supports, valves, tubing). Author (ESA)

N79-31441# General Accounting Office, Washington, D. C. Community and Economic Development Div.
GETTING A BETTER UNDERSTANDING OF THE METRIC SYSTEM: IMPLICATIONS IF ADOPTED BY THE UNITED STATES Report to the Congress
20 Oct. 1978 752 p refs
(PB-295498/0; CED-78-128) Avail: NTIS HC A99/MF A01 CSCL 14B

The issues involved in metrication are presented and discussed. GRA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking.*

N79-31442 British Broadcasting Corp., Kingswood (England). Research Dept.
THE LIMITATION OF RESOLUTION OF A COLOUR TELEVISION DISPLAY BY THE SAMPLING CHARACTERISTICS OF THE SHADOW MASK
C. R. G. Reed Jun. 1979 23 p refs
(BBC-RD-1979/11) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

The resolution of color-television displays on shadow-mask tubes, either of the traditional type in which the guns are grouped in delta-formation around the tube axis or the more recent type in which they lie in a horizontal plane can be limited by the sampling action of the mask structure. The patterning produced on large uniform areas and the resolution of single edges and repetitive detail, taking account of the line structure of the raster and the apertures in the shadow mask but assuming that the information is stationary, were considered. M.M.M.

N79-31443*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
LINEAR APPROXIMATION SAR AZIMUTH PROCESSING STUDY Final Report
R. B. Lindquist, R. K. Masnaghetti, E. Belland, H. V. Hance, and W. G. Weis 20 Mar. 1979 91 p refs Sponsored in part by DOE Prepared for JPL
(Contracts NAS7-100; JPL-955072)
(NASA-CR-162169; LMSC-D615761) Avail: NTIS HC A05/MF A01 CSCL 17I

A segmented linear approximation of the quadratic phase function that is used to focus the synthetic antenna of a SAR was studied. Ideal focusing, using a quadratic varying phase focusing function during the time radar target histories are gathered, requires a large number of complex multiplications. These can be largely eliminated by using linear approximation techniques. The result is a reduced processor size and chip count relative to ideally focussed processing and a correspondingly increased feasibility for spaceworthy implementation. A preliminary design and sizing for a spaceworthy linear approximation SAR azimuth processor meeting requirements similar to those of the SEASAT-A SAR was developed. The study resulted in a design with approximately 1500 IC's, 1.2 cubic feet of volume, and 350 watts of power for a single look, 4000 range cell azimuth processor with 25 meters resolution. M.M.M.

N79-31444# Purdue Univ., Lafayette, Ind. School of Electrical Engineering.
SEGMENTATION AND STRUCTURE ANALYSIS FOR REAL-TIME TRACKING Final Report, 28 Sep. 1977 - 31 Jan. 1979
Owen R. Mitchell, Keinosuke Fukunaga, and Anthony P. Reeves 2 Apr. 1979 66 p refs
(Grant DAAG29-77-G-0233)
(AD-A069303; ARO-15541.2-R-EL) Avail: NTIS HC A04/MF A01 CSCL 17/5

Several results related to real-time tracking are presented. These are: (1) classification of three-dimensional objects and calculation of their orientation using Fourier descriptors; (2) shape analysis of three-dimensional objects using local shape descriptors; (3) sequential image analysis using a parallel binary array processor; and (4) the use of edge information in segmentation and tracking. GRA

N79-31445# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
RADAR RECEIVER BANDWIDTH, TEST OPERATIONS PROCEDURE Final Report
28 Feb. 1979 13 p
(AD-A069335; TOP-6-2-555) Avail: NTIS HC A02/MF A01 CSCL 17/9

A method of measuring bandwidth by Swept Frequency Technique, in a government or contractor's laboratory, on any type radar - fixed, mobile, airborne or portable is presented. This method is useful for fixed frequency or tunable radar, and shows the quality of the frequency response. GRA

N79-31446# Hughes Aircraft Co., Fullerton, Calif. Ground Systems Group.
AN/TPQ-37 TRANSMITTER TEST BED Interim Report, Oct. 1978 - Jan. 1979
W. L. McPeak and E. J. Bonem Feb. 1979 34 p refs
(Contract DAAB07-78-C-3010)
(AD-A069975; FR-79-14-261; DELET-TR-78-3010-1; IR-1) Avail: NTIS HC A03/MF A01 CSCL 17/9

The AN/TPQ-37 Transmitter Test Bed will provide a vehicle for evaluating techniques for improving the reliability and maintainability of the AN/TPQ-37 Transmitter. Work includes design and fabrication of a major portion of the microprocessor based fault isolation subsystem. Support has been provided to ERADCOM in initiating procurement of Advanced Design Traveling Wave Tubes. During a later phase of the program these TWT's will be evaluated in the AN/TPQ-37 Transmitter. Author (GRA)

N79-31447# Illinois Univ. at Urbana-Champaign. Coordinated Science Lab.
CODING FOR THE CONTROL OF INTERSYMBOL INTERFERENCE IN BASEBAND CHANNELS Ph.D. Thesis
Val Anthony DiEuliis Dec. 1978 126 p refs
(Contracts DAAB07-72-C-0259; DAAG29-78-C-0016; Grant NSF ENG-75-22621)
(AD-A069781; R-830; UILU-ENG-2223) Avail: NTIS HC A07/MF A01 CSCL 09/4

The relationship between the structure of line codes and the error probability for baseband PCM systems with intersymbol interference is studied for a broad class of finite-state-machine codes. The model for a repeatered transmission line is reduced to a digital model including the line encoder, linear dispersive digital channel, additive Gaussian noise, and a fixed threshold detector. The error probability for a first order channel model (exponential response) is then found numerically using the Gram-Charlier series representation for the Gaussian noise probability density function. In order to accomplish this computation, the moments of the intersymbol interference are derived for this channel model via a property of the encoded channel sequence statistics. The error probability results are used to show that a simple approximation for channels which cause appreciable intersymbol interference over a span of many symbols (for example, more than fifty) provides accurate results. This approximation demonstrates the multimodal nature of the probability density of intersymbol interference, and suggests a new method of decision feedback equalization which removes most of the deleterious effects of the intersymbol interference on the error probability. It is also shown that the error propagation which is inherent in decision feedback equalizers can be effectively controlled with this new equalizer. GRA

N79-31448# Lincoln Lab., Mass. Inst. of Tech., Lexington.
HOWLS LOCATER COMPUTER PROGRAM: DESCRIPTION AND USER'S GUIDE
Edward T. Bayliss and James H. Cosgrove 26 Dec. 1978 227 p refs
(Contract F19628-78-C-0002; ARPA Order 2752)
(AD-A070452; TT-14; ESD-TR-78-377) Avail: NTIS HC A11/MF A01 CSCL 19/4

LOCATER is a computer program used to simulate projectile tracking radar estimation of weapon locations from real or simulated projectile tracking data. A complete mathematical description of the modified point mass trajectory modeling, radar random errors, wind, refraction, multipath and the likelihood estimator is included. Detailed user instruction and samples are covered. A programmer's guide to modification of the 7000 line FORTRAN program is included. GRA

N79-31449# Operating Systems, Inc., Woodland, Calif.
FTD USER COMMUNICATIONS DEVELOPMENT Final Technical Report, 27 Sep. 1977 - 30 Sep. 1978
J. A. Balter, A. Tomlinson, and R. V. Weeks Griffiss AFB, N.Y. RADC May 1979 78 p refs
(Contract F30602-77-C-0220; AF Proj. 2053)
(AD-A070934; OSI-R79-005; RADC-TR-79-94) Avail: NTIS HC A05/MF A01 CSCL 17/2

This report describes the evolution of the FTD User Communications System concept from an expanded query facility for specific FTD Scientific and Technical Information System (STIS) to a facility running on a minicomputer and supporting a range at computer-based activities, including a generalized data base and file access, text handling and report generation, calculation, simple plots and graphics, and access via direct links to programs and data on large mainframes. The User Communication System (UCS) design is based on a Digital Equipment Corporation PDP-11/70, to which are attached a number of devices, and peripherals. The report describes the development of a 'breadboard' UCS which would initially support two user workstations. Each workstation would provide an intelligent alphanumeric terminal, an interactive graphics display, a function button keyboard for the entry of User Language commands, and a cassette disk for storing personnal work files in progress. A major emphasis in the UC System was the design of a powerful, but simple and easy-to-use language. This language would adjust to the skill level of the user and would provide a unified and integrated means of executing a diversity of functions. In addition, users would be able to utilize the functional building blocks of the language to define their own functions. GRA

N79-31450# Ohio State Univ., Columbus. Electroscience Lab.
RADAR TARGET IDENTIFICATION Final Technical Report, 1 Mar. 1977 - 30 Sep. 1978
D. M. Moffatt, K. A. Shubert, and E. M. Kennaugh Griffiss AFB, N. Y. RADC May 1979 71 p refs
(Contract F19628-77-C-0125; AF Proj. 2305)
(AD-A070793; ESL-784677-2; RADC-TR-79-118) Avail: NTIS HC A04/MF A01 CSCL 17/9

This report presents a review of the radar target identification problem with primary emphasis on practical solutions as opposed to abstract inverse scattering formalisms. A time domain viewpoint is stressed throughout because of its compactness, ease of visualization and diagnostic potential and because it is a unifying tool for various electromagnetic approximations. A small finite set of excitation invariant target descriptors, the coefficients of a linear, homogeneous difference equation, or equivalently the complex natural resonances, are justified as a discrimination tool. A prediction-correlation method for using these coefficients in identification is demonstrated. It is shown that substructure features of the targets, in this case vertical and horizontal stabilizers of aircraft, possibly can be used as a discrimination feature and that the required interrogating radar signal spectrum for this case is significantly higher than that required for previous discrimination schemes using excitation invariant parameters. In this specific case, however, the target parameters do not have a simple physical interpretation. GRA

N79-31451# Mitre Corp., Bedford, Mass.
ANALYTIC AND SIMULATION RESULTS FOR CSMA CONTENTION PROTOCOLS
C. E. Labarre May 1979 38 p refs
(Contract F19628-79-C-0001; AF Proj. 4810)
(AD-A070672; MTR-3672; ESD-TR-79-126) Avail: NTIS HC A03/MF A01 CSCL 17/2

The behavior and comparative performance of the Listen-While-Talk (LWT) and Listen-Before-Talk (LBT) CSMA contention protocols are examined using analytic and simulation techniques. The equilibrium throughput and delay equations for the non-persistent LBT and LWT protocols are derived. Simulation results are provided for the 1-persistent LWT and LBT protocols as implemented on the MITRE coaxial cable system. The throughput and delay performance of the LWT protocol is demonstrated to be superior to that of other contention protocols for use in local networks. Dynamic control procedures, similar to those used in other contention systems, are applicable to LWT CSMA protocols. GRA

N79-31452# California Univ., Livermore. Lawrence Livermore Lab.
INVERSION OF ONE-DIMENSIONAL SCATTERING DATA USING PRONY'S METHOD
E. K. Miller and D. L. Lager 12 Feb. 1979 15 p refs
(Contract W-7405-eng-48)
(UCRL-52667) Avail: NTIS HC A02/MF A01

Application of Prony's method, a procedure for obtaining the poles of exponential signals, to such one dimensional problems is considered. Both time-domain and frequency-domain data are analyzed. The effects of the medium characteristics, number of layers, and other factors are examined. It is concluded that Prony's method has merit for certain classses of one dimensional inverse problems. DOE

N79-31453# TICRA ApS, Copenhagen (Denmark).
STUDY OF TECHNIQUES FOR THE DESIGN OF HIGH GAIN ANTENNAS WITH CONTOURED BEAMS Final Report
P. Balling, R. Joergensen, and K. Pontoppidan Dec. 1978 256 p refs
(Contract ESTEC-3371/77-NL-AK(SC))
(S-89-02; ESA-CR(P)-1178) Avail: NTIS HC A12/MF A01

A contoured-beam antenna concept is considered involving the use of a large reflector system in combination with a multiple-feed array. High-gain antennas with contoured beams are envisaged as being used in future satellite systems, e.g. for direct TV broadcast and telecommunication. Different synthesis methods are compared prior to the selection of one method. The implementation of the selected method into general synthesis software as well as the application of the developed software to practical synthesis examples are described. Author (ESA)

N79-31454# Institute of Microwave Technology, Stockholm (Sweden).
A STUDY OF A LOW NOISE MILLIMETER WAVE MIXER Final Report
Florian Sellberg 31 Dec. 1978 104 p
(Contract ESTEC-3144/77-NL-AK(SC))
(ESA-CR(P)-1191) Avail: NTIS HC A06/MF A01

A breadboard model of a broadband 30/11 GHz mixer with low conversion loss was designed, measured, and delivered. Schottky-barrier mixer diodes of different makes were characterized and one type was selected for the mixer. Filter circuits for the mixer ports were specified and designed. The mixer section was optimized with regard to diode loading at the mixer frequencies. Special attention was paid to image enhancement in proper phase and to trapping of local oscillator harmonics. Due mainly to the inherent high Q of the packaged mixer diodes available, the instantaneous bandwidth was restricted to 2 GHz with mechanical tuning over the full 3.5 GHz originally specified. The conversion loss in this bandwidth can be kept below 5.6 dB with a maximum input of 3.1:1 over the whole range of operating temperature and IF load mismatch. A low local oscillator power (2 to 3 mW) was chosen to minimize the gain variation. At delivery the mixer was tuned to a bandwidth of 1.4 GHz with conversion loss below 4.6 dB and input VSWR below 2:1 (room temperature and load VSWR = 1.0:1). Author (ESA)

N79-31455# Politecnico di Torino (Italy). Inst. di Electtronica e Telecomunicazioni.
PERFORMANCE ANALYSIS OF A NONLINEAR SATELLITE CHANNEL USING VOLTERRA SERIES Final Report
M. Ajmone-Marsan, S. Benedetto, E. Biglieri, and R. Daffara Dec. 1977 130 p refs
(Contract ESTEC-2328/74-HP)
(ESA-CR(P)-1212) Avail: NTIS HC A07/MF A01

An analytical treatment of digital satellite communication systems operating over nonlinear channels is presented. The effect of a nonlinear amplifier located in the satellite is considered in combination with that of transmitting and receiving filters located in the earth stations. In addition, both uplink and downlink noise are taken into account. The analysis method is based on a Volterra series representation of the overall channel. The basic advantage of this approach is the generality it offers for the study and an important achievement is that accurate evaluation of the error probability in a digital communication scheme is possible in a short computer time. The technique is applied to a coherent PSK scheme in which the program VOLPSK is used. A users manual, programmers manual, and list of programs is included for this evaluation. Author (ESA)

N79-31456# National Technical Information Service, Springfield, Va.
SPREAD SPECTRUM COMMUNICATIONS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Apr. 1979
William E. Reed May 1979 105 p Supersedes NTIS/PS-78/0489
(NTIS/PS-79/0494/9; NTIS/PS-78/0489) Avail: NTIS HC $28.00/MF $28.00 CSCL 17B

The bibliography cites Federally-funded research on the techniques, equipment, and applications of spread spectrum communications. Topics include pseudonoise modulation, coding, signal processing, synchronization, antijamming, interference rejection, antennas, and the use of surface acoustic wave technology. Applications include satellite, television, secure communication, multiplex, and multiple access systems. (This updated bibliography contains 99 abstracts, 22 of which are new entries to the previous edition.) GRA

N79-31457# National Technical Information Service, Springfield, Va.
SPREAD SPECTRUM COMMUNICATION. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Apr. 1979
William E. Reed May 1979 123 p Supersedes NTIS/PS-78/0490
(NTIS/PS-79/0495/6; NTIS/PS-78/0490) Avail: NTIS HC $28.00/MF $28.00 CSCL 17B

Research reports from worldwide literature are cited on the techniques, equipment, and applications of spread spectrum communications. Topics include pseudonoise modulation, coding, signal processing, synchronization, antijamming interference rejection, antennas, and the use of surface acoustic wave technology. Applications include satellite, secure communication, multiplex, and multiple access systems. (This updated bibliography contains 118 abstracts, 44 of which are new entries to the previous edition.) GRA

N79-31458# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
DIGITAL COMMUNICATIONS IN AVIONICS
Heinz Lueg, ed. (Technische Hochschule, Aachen, West Ger.) Jun. 1979 456 p refs In ENGLISH and FRENCH Presented at the Avionics Panel Symp., Munich, 5-9 Jun. 1978
(AGARD-CP-239; ISBN-92-835-0242-6) Avail: NTIS HC A20/MF A01

The technology of digital communications is addressed. Communications between air and/or ground terminals and relay communications, both satellite-borne and air-borne, improvement of communication in the case of multipath transmission by means of spectrum techniques, echo cancelling, or pulse compression, and improvement of jam resistance by means of power balance are among the topics discussed. Spread spectrum techniques, error protection coding, and cost effective improvements in performance in the presence of noise and interference are also

considered. For individual titles, see N79-31459 through N79-31496.

N79-31459# Defense Communications Agency, Washington, D.C.
THE IMPACT OF DIGITIZATION ON MILITARY COMMUNICATIONS
Irwin L. Lebow *In* AGARD Digital Commun. in Avionics Jun. 1979 16 p refs (For primary document see N79-31458 22-32)
Avail: NTIS HC A20/MF A01

The U. S. Defense Communications System (DCS) subsystems which provide switched services and dedicated transmission are described. It is shown that a second-generation system with the common theme of digitization to improve secure voice capability is designed to maximize interoperability with tactical, civil, and allied secure voice systems. This system is based upon a common user secure voice system, AUTOSEVOCOM 2, used in conjunction with dedicated satellite transmission employing transportable terminals for robustness. J.M.S.

N79-31460# Centre d'Essais en Vol, Bretigny-sur-Orge (France).
TECHNICAL AND OPERATIONAL ASPECTS OF TELECOMMUNICATIONS IN AERONAUTICS [LES ASPECTS TECHNIQUES ET OPERATIONNELS DES TELECOMMUNICATIONS EN AERONAUTIQUE]
Carlier Maurice *In* AGARD Digital Commun. in Avionics Jun. 1979 4 p In FRENCH (For primary document see N79-31458 22-32)
Avail: NTIS HC A20/MF A01

The principle information requirements for air defense stations are reviewed and constraints peculiar to telecommunciations in aeronautics are examined. Solutions to aircraft communication problems developed since the end of World War 2 are assessed as well as the need for a communication system to provide for navigation, identification, and anticollision functions. Such a time division multiple access system will supply numerical information in messages of short duration, use a large frequency band, synchronize all participants in the network, and access each participant during a determined time, at regular intervals or periods. A.R.H.

N79-31461# Carleton Univ., Ottawa (Ontario). Dept. of Systems Engineering and Computing Science.
A NOVEL APPROACH TO THE DESIGN OF AN ALL DIGITAL AERONAUTICAL SATELLITE COMMUNICATION SYSTEM
M. E. Ulug *In* AGARD Digital Commun. in Avionics Jun. 1979 16 p refs (For primary document see N79-31458 22-32)
Avail: NTIS HC A20/MF A01 CSCL 17B

The design of an all digital aeronautical satellite communication system based on the transparent intelligent network (TI-NET) is described. The novel features of the system, namely a 9.6 kb/s ground to aircraft link which provides a TDMA operation and the statistical multiplexing of the encoded voice and data were experimentally tried out using 12-14 GHz satellite link between Carleton University, in Ottawa, Canada and the NASA AMES Research Center in Palo Alto, California using Hermes (CTS) satellite. Other unique features of the system are the trading off of the satellite up-down delay with the packet formation delay, multi-polling and multiaddressing capability, and the complete transparency to the user's protocol. In addition, the system has a turn around time of 22.5 ms. which is most useful in making quick changes in the polling sequence, as well as producing fast re-transmissions. A polling algorithm which meets the particular needs of the aircraft in high, medium, and low density areas is described. The terrestrial network connecting the communication centers and ground stations in North America is also discussed and its associated interfaces and protocols are defined. It is believed that the proposed system will result in a more efficient use of the communication channels, greater immunity against noise, and a less complex airborn computer with smaller memory. Although the system design is based on a set of hypothetical traffic data, the model can be readily modified to perform at a higher or lower traffic level. In this connection another system using a 4.8 kb/s ground-aircraft link is described and its performance compared with that of the proposed model. J.M.S.

N79-31462# Communications Research Centre, Ottawa (Ontario).
CENSAR TDMA: CENTRALIZED SYNCHRONIZATION AND RANGING FOR TIME-DIVISION MULTIPLE ACCESS
Peter P. Nuspl *In* AGARD Digital Commun. in Avionics Jun. 1979 8 p refs (For primary document see N79-31458 22-32)
Avail: NTIS HC A20/MF A01

Experiments in synchronization for time division multiple access systems for satellite communications are discussed. The basic principles of the new synchronization ranging concept called CENSAR and the technological requirements are covered. Hardware and software features of the implementation are described and the results are discussed. A major result is that this open-loop synchronization method is feasible with guard times of less than 30 ns. J.M.S.

N79-31463# Eurocontrol Agency, Maastricht (Netherlands).
A DIGITAL COMMUNICATION SYSTEM AS GATEWAY BETWEEN ADJACENT COMPUTERIZED AIR TRAFFIC CONTROL CENTRES
M. Baum *In* AGARD Digital Commun. in Avionics Jun. 1979 14 p refs (For primary document see N79-31458 22-32)
Avail: NTIS HC A20/MF A01

A practical approach to improve data communication between adjacent computerized air traffic control centers is described. The applied concept is communication procedure conversion by which systems with incompatible transmission procedures can communicate with each other via a gateway system. Procedure conversion meets the basic requirement which is not to intervene in the functioning of the involved local networks and not to require modifications of locally used procedure envelopes. The transit function is realized by conversion of the procedure specific message type and priority on one hand and of address information on the other hand. A flexible table mechanism is chosen instead of fixed coding. Outstanding problems are an efficient link failure processing and an envisaged attachment of a circuit switching function to the message switching principle. J.M.S.

N79-31464# California Univ., Los Angeles. Dept. of System Science.
A MARKOV MODEL FOR NONLINEAR CHANNELS WITH MEMORY AND SOME APPLICATIONS
Ezio Biglieri (Politecnico di Torino, Italy) *In* AGARD Digital Commun. in Avionics Jun. 1979 9 p refs Sponsored in part by ONR (For primary document see N79-31458 22-32)
Avail: NTIS HC A20/MF A01

A Markov chain model is proposed for the analysis of bandlimited, and possibly nonlinear, digital communication channels. The fundamental feature of this approach is its analytical tractability, as well as its flexibility. From this model several results can be obtained in a relatively straightforward way. An application considered is the evaluation of the signal power spectrum at the channel output. The bandwidth occupancy, and hence the interference among adjacent channels, in a multiple-user communication situation subject to spectrum spread due to a nonlinearity (a typical example occurs in digital satellite communication systems) is evaluated. As another application, the structure of the optimum (maximum likelihood sequence) receiver for a channel modeled in this way is derived, and a Viterbi algorithm is set up for the demodulation of a digital signal. J.M.S.

N79-31465# Massachusetts Univ., Amherst. Dept. of Electrical and Computer Engineering.
STATE OF THE ART OF ERROR CONTROL TECHNIQUES
Jack Keil Wolf *In* AGARD Digital Commun. in Avionics Jun. 1979 12 p refs (For primary document see N79-31458 22-32) (Grant AF-AFOSR-2601-74)
Avail: NTIS HC A20/MF A01

A survey of error control techniques for achieving reliable transmission over noisy communication channels is presented. Both binary and nonbinary codes are considered. Block codes and tree codes are described along with their decoding algorithms. The parameters of the most frequently utilized codes are given. Finally, the performance of such codes are considered for an additive Gaussian noise channel with and without Rayleigh fading. J.M.S.

N79-31466# Communications Research Centre, Ottawa (Ontario). Dept. of Communications.

FORWARD ERROR-CORRECTION FOR THE AERONAUTICAL SATELLITE COMMUNICATIONS CHANNEL

Alan Sewards, Leo Beaudet, and Hassan Ahmed *In* AGARD Digital Commun. in Avionics Jun. 1979 14 p refs Prepared in cooperation with Miller Commun. Systems Ltd., Kanata, Ont. (For primary document see N79-31458 22-32)

Avail: NTIS HC A20/MF A01

The problems caused in an L-band aeronautical satellite communications channel by ocean surface multipath are identified. It is shown that data messages transmitted over the channel exhibit unacceptably high error rates under typical conditions. Channel characteristics and techniques for reducing the error rate are discussed, leading to the choice of a diffuse threshold decodable convolutional forward error correcting code. Two implementations of coder/decoders for this code are described, one using standard IC logic, and the other a Z-80A microprocessor. Results of tests of the IC coder/decoder with noise, data error bursts, and a system simulator are quoted, which show that the codec performed as expected and is capable of reducing the error rate to 0.00001 or better. J.M.S.

N79-31467# Manchester Coll. of Science and Technology (England). Dept. of Electrical Engineering and Electronics.

AN EXPERIMENTAL EVALUATION OF INTERLEAVED BLOCK CODING IN AERONAUTICAL HF CHANNELS

Brian Hillam and Geoffrey F. Gott *In* AGARD Digital Commun. in Avionics Jun. 1979 4 p refs Sponsored by the Ministry of Defence (For primary document see N79-31458 22-32)

Avail: NTIS HC A20/MF A01

Results obtained from the application of forward error correcting block codes to a 75 baud frequency shift keyed data transmission system, operating in aeronautical hf channels are presented. Six different binary cyclic codes were tested, using detailed error structures obtained from point-to-point link tests. In an attempt to randomize error bursts, which arise because of fading and interference on the channel, interleaving of the codeword bits was employed, using several different degrees of interleaving for each code. J.M.S.

N79-31468# Standard Elektrik Lorenz A.G., Stuttgart (West Germany).

AN ASYNCHRONOUS DATA TRANSMISSION SYSTEM WITH LOW ERROR PROBABILITY FOR THE SETAC LANDING AID

Wolfgang Beier *In* AGARD Digital Commun. in Avionics Jun. 1979 5 p (For primary document see N79-31458 22-32)

Avail: NTIS HC A20/MF A01

A serial code which is used in the TACAN compatible landing aid SETAC is described. Its features are optimized for the expected error rate and types of errors as well as for the data transmission rate and the accepted error rate after correction. R.E.S.

N79-31469# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Electrical Engineering.

ON THE PERFORMANCE OF A MAXIMUM LIKELIHOOD DECODER FOR CONVOLUTIONAL CODES

J. P. M. Schalkwijk *In* AGARD Digital Commun. in Avionics Jun. 1979 7 p refs Sponsored by the Netherlands Organ. for the Advan. of Pure Res. (For primary document see N79-31458 22-32)

Avail: NTIS HC A20/MF A01

A method of evaluating the event error probability for maximum likelihood decoding of convolutional codes is presented. To illustrate this method calculations were carried through for the simple rate 1/2 convolutional code generated by an encoder. Similar calculations were performed for the standard constraint length upsilon = 2 code with connection polynomials 1 + D2, ad 1 + D + D2. R.E.S.

N79-31470# Kent Univ., Canterbury (England). Electronics Labs.

DIGITAL COMMUNICATIONS USING SOFT-DECISION DETECTION TECHNIQUES

P. G. Farrell, E. Munday, and N. Kalligeros *In* AGARD Digital Commun. in Avionics Jun. 1979 19 p refs (For primary document see N79-31458 22-32)

Avail: NTIS HC A20/MF A01

The history of soft-decision techniques is briefly reviewed and the potential advantages of using such techniques are outlined. The experimental implementations of soft-decision schemes are described and evaluated. The results of some studies of quite simple block soft-decision decoding schemes are presented. Then a practical implementation of a data transmission system incorporating full minimum-distance soft-decision decoding is described. The system is based on a transparent product block code, with interleaving; and is suitable for use of HF, VHF and UHF channels. The results of tests on simulated and real channels are presented and commented on. It was concluded that efficient operation of data transmission systems with channel (redundant) coding is impossible without soft-decision detection, particularly in non-Gaussian environments. R.E.S.

N79-31471# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. of Communication Technology.

THEORETICAL LIMITS ON CHANNEL CODING UNDER VARIOUS CONSTRAINTS

B. G. Dorsch and F. Dolainsky *In* AGARD Digital Commun. in Avionics Jun. 1979 12 p refs (For primary document see N79-31458 22-32)

Avail: NTIS HC A20/MF A01

Theoretical limits on coding under some fundamental constraints of practical schemes were calculated, which were not taken into account in Shannon's absolute limit for Gaussian noise. First channel capacity (zero error probability with codes of infinite length) was considered for finite rate codes (finite energy per symbol, finite bandwidth), binary input and quantized output signals. Then the influence of finite length and finite error probability on the theoretical limits of coding was investigated for three decoding philosophies (maximum likelihood decoding, bounded minimum distance decoding and decoding with an optimum fixed threshold). It was found that the performance of practical coding schemes under certain constraints should be compared to these limits rather than the absolute Shannon limit. R.E.S.

N79-31472# Ruhr Univ., Bochum (West Germany). Inst. fuer Elektronik.

AN ERROR-RATE MEASUREMENT SET-UP OPERATING AT 1 GBIT/S

Ulrich Wellens *In* AGARD Digital Commun. in Avionics Jun. 1979 12 p refs (For primary document see N79-31458 22-32)

Avail: NTIS HC A20/MF A01

An error rate measurement set-up is described which directly operates at information rates near 1 Gbit/s. The transmitter delivers pseudo-random sequences which are generated by high speed base-coupled logic gates working in conjunction with two delay lines. In the error rate detector the bit stream, transmitted via the communications system under test, was compared with a reference bit stream from the transmitter in an exclusive gate. The discovered error bits were registered in a counter chain and divided by the total number of bits transmitted during an adjustable measurement time. The accuracy achieved with this equipment was better than 10 to the -9th power. Two application examples in utilizing the measurement set-up are described. In one of these the error rate versus the input signal power of a coaxial cable transmission path was determined. The other application was concerned with a special problem in an optical transmission system. R.E.S.

N79-31473# FGAN, Wachtberg-Werthhoven (West Germany).

INTRODUCTORY NOTES ON PROPAGATION EFFECTS AND RELATED ASPECTS

H. J. Albrecht *In* AGARD Digital Commun. in Avionics Jun. 1979 3 p (For primary document see N79-31458 22-32)

Avail: NTIS HC A20/MF A01

Fundamental information on propagation media is presented as a basis for subsequent papers which review the more detailed problem areas and illustrate typical applications. Comments on the trend in relevant research and development are also included. R.E.S.

N79-31474# Siemens A.G., Munich (West Germany).

PROPAGATION EFFECTS ON DIGITAL COMMUNICATION

IN AVIONICS (REVIEW PAPER)
Ernst Lampert *In* AGARD Digital Commun. in Avionics Jun. 1979 15 p refs (For primary document see N79-31458 22-32)
Avail: NTIS HC A20/MF A01

The different modes of electromagnetic wave propagation and their relevancy in avionics were investigated. The relevant propagation modes are then discussed in terms of frequency from the HF band to EHF region. Satellite communication was also discussed. R.E.S.

N79-31475# Northeastern Univ., Boston, Mass.
MODELLING OF PROPAGATION ASPECTS OF DIGITAL COMMUNICATION SYSTEMS
H. R. Raemer *In* AGARD Digital Commun. in Avionics Jun. 1979 11 p refs (For primary document see N79-31458 22-32)
Avail: NTIS HC A20/MF A01

Propagation considerations important in modelling of digital communication systems are reviewed. Nearly the entire radio frequency spectrum is covered. The following topics are briefly discussed: (1) basic channel modelling theory concepts; (2) systems analysis and design as it relates to propagation; and (3) the two channels, troposcatter and satellite-ground. R.E.S.

N79-31476# Royal Aircraft Establishment, Farnborough (England). Radio and Navigation Dept.
PERFORMANCE PREDICTIONS AND TRIALS OF A HELICOPTER UHF DATA LINK
R. M. Harris *In* AGARD Digital Commun. in Avionics Jun. 1979 17 p refs (For primary document see N79-31458 22-32)
Avail: NTIS HC A20/MF A01

A combination of theoretical and experimental studies conducted in order to estimate the bit error rate performance of a digital communication system are reviewed. The system is proposed for the transmission of binary digital data over dedicated simplex UHF radio links between helicopters, and between helicopters and ships. Initial predictions of system performance were based on known characteristics of some helicopter-installed systems and classical treatment of multipath radio wave propagation over a smooth sea. The probability of achieving a particular grade of service was considered as the arithmetical product of several independent statistical parameters. Some of these were related to the temporal and spatial variability of radio wave propagation; others reflected the almost random orientation of the aircraft under operational conditions affecting the signal received via the aircraft's radiation pattern. A method of statistical analysis based on approximate Gaussian frequency distribution functions was applied to the experimental data. Performance predictions are presented in terms of time availability for selected bit error rates. R.E.S.

N79-31477# Air Force Geophysics Lab., Hanscom AFB, Mass.
NEW INSIGHT INTO IONOSPHERIC IRREGULARITIES AND ASSOCIATED VHF/UHF SCINTILLATIONS
J. Buchau, E. J. Weber, and H. E. Whitney *In* AGARD Digital Commun. in Avionics Jun. 1979 26 p refs (For primary document see N79-31458 22-32)
Avail: NTIS HC A20/MF A01

Using a new all-sky photometer and airborne/ground based sounding, the large scale structure of equatorial irregularity regions responsible for VHF/UHF scintillations was determined. Field aligned electron density depletions of >1200 km north-south extent develop after sunset in the bottomside of the equatorial ionosphere and move towards the east at approximately 100 m/sec. The lifetime of these depletions is several hours. They are the seat of irregularities (scale sizes meters to kilometers) which extend from the bottomside to > 800 km height. They occur single or in groups and result in scintillations of traversing signals. At arctic latitudes, the irregular F region ionization resulting from soft particle precipitation is often associated with auroral forms. These forms were made visible with the all-sky photometer and scintillation events observed on VHF/UHF were related to the observed features. Airborne scintillation measurements at the equator show strong dependence of the fading rate on aircraft heading, a result of eastward drift of the irregularities. Ground based measurements show, that space diversity and time diversity are effective means to operate under strongly scintillated conditions. R.E.S.

N79-31478# Technische Universitaet, Brunswick (West Germany).
MULTIPATH PROPAGATION MEASUREMENT BY DOPPLER TECHNIQUE
P. Form, R. Springer, H. Bothe, and K. Klein *In* AGARD Digital Commun. in Avionics Jun. 1979 23 p refs Prepared in cooperation with DFVLR, Brunswick (For primary document see N79-31458 22-32)
Avail: NTIS HC A20/MF A01

Some microwave landing system features are discussed with respect to multipath propagation. For illustration of specific multipath effects, a Doppler-shift measurement technique with high angle resolution is presented, which needs simple antennas and equipment and offers easy interpretation. M.M.M.

N79-31479# Transportation Systems Center, Cambridge, Mass.
A CHANNEL SIMULATOR FOR L-BAND SATELLITE-MOBILE COMMUNICATIONS
Peter D. Engels *In* AGARD Digital Commun. in Avionics Jun. 1979 10 p refs (For primary document see N79-31458 22-32)
Avail: NTIS HC A20/MF A01

A laboratory simulator which enables the characterization of any variety of experimental modems in the presence of simulated multipath and noise is described. Such a procedure is advantageous in cost savings, repeatibility, and comprehensiveness. M.M.M.

N79-31480# Technische Universitaet, Brunswick (West Germany). Inst. fuer Nachrichtentechnik.
INVESTIGATION ON INFORMATION ERROR CAUSED BY TRAFFIC LOADING IN APPROACH AND LANDING SYSTEMS
Wolfgang Skupin *In* AGARD Digital Commun. in Avionics Jun. 1979 15 p (For primary document see N79-31458 22-32)
Avail: NTIS HC A20/MF A01

For the evaluation of a required approach and landing systems with statistical interrogation ALSSI serving capacity, a traffic model was developed. This model is based on the operational requirements and gives a defined standard traffic volume for a ALSSI. For investigating the reply efficiency and the accuracy of an ALSSI several methods can be employed. By means of probability calculations the reply efficiency can be determined with comparatively low expense. For the determination of the accuracy it is useful to carry out real world system tests with a test a/c. Because of less expense the traffic load is simulated with these tests by pulse generators. More flexibility can be achieved by employing a software simulation. For this a computer model of the traffic loading has to be installed as well as a computer model of the system to be investigated. Some results achieved by employing these methods are presented. M.M.M.

N79-31481# Rome Air Development Center, Griffiss AFB, N.Y.
NEW DEVICES FOR DIGITAL COMMUNICATIONS IN AVIONICS
F. I. Diamond, H. J. Bush, and J. A. Graniero *In* AGARD Digital Commun. in Avionics Jun. 1979 9 p refs (For primary document see N79-31458 22-32)
Avail: NTIS HC A20/MF A01

Technological advances in microelectronics to improve capabilities and reduce complexity of digital communication systems in the aircraft industry are assessed. M.M.M.

N79-31482# California Univ., San Diego, La Jolla.
TRANSFORM DOMAIN PROCESSING FOR DIGITAL COMMUNICATION SYSTEMS USING SURFACE ACOUSTIC WAVE DEVICES
L. B. Milstein, D. R. Arsenault, and P. Das *In* AGARD Digital Commun. in Avionics Jun. 1979 16 p refs Prepared in cooperation with Rensselaer Polytech. Inst. (For primary document see N79-31458 22-32)
(Grant DAAG29-77-G-0205)
Avail: NTIS HC A20/MF A01

A surface acoustic wave receiver is presented. This device is light and small enough to be used on board aircraft and can receive continuous time-digital signals accurately and securely. The detection of digital signals in the presence of Gaussian noise and interference using this device is studied. M.M.M.

N79-31483# California Univ., Los Angeles. Dept. of System Science.

AN ANALYSIS OF THE ERROR PROBABILITY OF AN ALL DIGITAL DETECTOR

Sam Reisenfeld and Kung Yao *In* AGARD Digital Commun. in Avionics Jun. 1979 13 p refs Sponsored by the ONR (For primary document see N79-31458 22-32)

Avail: NTIS HC A20/MF A01

Several analytical approaches are taken to evaluate the error probability of a digital communications system with a detector implemented as a digital signal processor. A binary hypothesis problem over an AWGN channel, where the receiver consists of a low-pass filter, a sampler, a dynamic range scaling device, an A/D converter, a digitally implemented integrate-and-dump filter, and a threshold device is considered. The digital processing for the receiver is done with fixed-point arithmetic. Exact error probability expressions are given for cases of overflow and no overflow in the integrate-and-dump filter. Approximate expressions for P sub e, which depend upon approximations of the moments of the quantization error, are obtained. The P sub e expressions are derived as functions of E sub b/n sub o, the number of bits in the integrate-and-dump filter output, the number of samples per binary symbol, and the dynamic range scaling factor. Numerical examples illustrating the above analytical approaches are given. M.M.M.

N79-31484# Johann-Wolfgang-Goethe-Universitat, Frankfurt am Main (West Germany). Inst. fuer Angewandte Physik.

ASPECTS OF SOURCE ENCODING

Dietrich Wolf *In* AGARD Digital Commun. in Avionics Jun. 1979 6 p refs (For primary document see N79-31458 22-32)

Avail: NTIS HC A20/MF A01

After some general remarks on the concepts of source encoding some illustrative examples of actual interest are presented. In particular, recent results on source models of bandpass-limited speech signals, on optimum quantization of nonGaussian random sources, on data compression encoding schemes for speech and television signals are discussed. Author

N79-31485# Johann-Wolfgang-Goethe-Universitat, Frankfurt am Main (West Germany). Inst. fuer Angewandte Physik.

PROBLEMS IN COMBINING SOURCE AND CHANNEL CODING

Hans Juergen Matt *In* AGARD Digital Commun. in Avionics Jun. 1979 12 p refs (For primary document see N79-31458 22-32)

Avail: NTIS HC A20/MF A01

Some problems in combining source and channel coding are discussed. By the example of DPCM coded video signals the effects of channel errors were analyzed to see how these effects could be minimized. An adaption strategy for source- and channel codecs is proposed based on the fact that channel decoders are particulary suited to correct small numbers of errors occurring with high probability so that greater numbers of errors occurring less frequently are left to the source decoder for reconstruction. For protection of the compressed signals a low cost tri-state channel code is proposed and its performance is outlined. Finally, the problem of optimizing a transmission system as a whole is shown to be a variational problem relating the cost of the system to the signal quality (distortion) produced at the receiver. Its solution leads to a cost-distortion function which may include all relevant parameters of the transmission system's components. M.M.M.

N79-31486# Technische Universitaet, Hanover (West Germany). Lehrstuhl fuer Theoretische Nachrichtentechnik und Informationservarbeitung.

SEGMENTATION OF PICTURES INTO CHANGING AND MOVING PARTS FOR FRAME REPLENISHMENT CODING TECHNIQUES

Juergen Klie *In* AGARD Digital Commun. in Avionics Jun. 1979 10 p refs (For primary document see N79-31458 22-32)

Avail: NTIS HC A20/MF A01

A method is described which allows the segmentation of a video signal in changing and unchanging parts. The segmentation is done by comparing the average absolute value of five adjacent frame-to-frame differences to a threshold of 1.2/256. The segmentation algorithm detects only those frame areas which have changed their information visibly. This is done for a mimimum number of picture elements by using relatively long clusters, which in turn increases the bit rate reduction for conditional replenishment coders. In addition to the segmentation of the frame in changing and unchanging areas, a method is explained which allows an exact distinction between moving areas and uncovered background. This can be used for instance for the purpose of bit rate reduction by adapting the spatial sampling frequency to the reduced spatial resolution in the moving areas which depends on the velocity. Author

N79-31487# Rensselser Polytechnic Inst., Troy, N. Y. Electrical and Systems Engineering.

STATE OF THE ART IN DIGITAL SIGNAL PROCESSING WITH APPLICATIONS TO MULTIPLE ACCESS SYSTEMS

Lester A. Gerhardt *In* AGARD Digital Commun. in Avionics Jun. 1979 9 p refs (For primary document see N79-31458 22-32)

Avail: NTIS HC A20/MF A01

Advanced developments and trends in the fields of digital signal processing and digital communications were reported. The effects of microprocessors and minicomputers in this development were addressed. The availability of new devices, device technology, and directions are summarized with respect to the emphasis on speed. A discussion of CDM, CDMA, SSMA, and TDMA was reported. The Joint Tactical Information Distribution System was described as a system concept. M.M.M.

N79-31488# Thomson-CSF, Gennevilliers (France). Div. Telecommunications.

THE TELEGRAPH MODEM AT SPREAD SPECTRUM [MODERN TELEGRAPHTIQUE A ETALEMENT DE SPECTRE]

D. Brisset and G. Auger *In* AGARD Digital Commun. in Avionics Jun. 1979 7 p refs In FRENCH (For primary document see N79-31458 22-32)

Avail: NTIS HC A20/MF A01

A modem for spread spectrum telegraphy was included in the design of an experimental satellite communication station and is being evaluated the Symphonie satellite. The information transmitted is in a telegraphic rhythm at 75 bits/s, using a differential coding followed by a PSK bi-phase modulation. The spectrum spread is achieved in a band of several tens of MHz by means of PN sequence at elevated rhythm. In relation to other multiple access techniques, (FDMA, TDMA, without frequency) the advantages of this transmission of the SSMA type are: multiple access without requiring centralized management of the network, discretion, resistance to interference, and reduced complexity of equipment involved in ground stations and onboard the satellite. On the other hand, the capacity for transmission is inferior to that of other modes of multiple access. Transl. by A.R.H.

N79-31489# Technische Hochschule, Aachen (West Germany). Inst. fuer Elektrische Nachrichtentechnik.

THE PERFORMANCE OF CODE DIVISION MULTIPLEXING WITH PULSE POSITION MODULATION

Juergen Lindner *In* AGARD Digital Commun. in Avionics Jun. 1979 11 p refs (For primary document see N79-31458 22-32)

Avail: NTIS HC A20/MF A01

Pulse position modulation (PPM) is considered for code division multiplexing (CDM) in order to find attractive alternatives to PCM for the transmission of analog data over a CDM system. The relations between the output signal to interference ratio, the number of users and the bandwidth on the channel are calculated and an attempt is made to optimize the binary sequences used as carrier functions. Binary sequences are presented having autocorrelation functions (ACF) which are relatively good approximations to the optimal ones. By means of some known results it is shown that the crosstalk properties, given by the crosscorrelation functions (CCF) of the binary sequences, are fixed. The characteristics of CDM/PPM and CDM/PCM are compared and, a PPM receiver is presented, leading to low cost and effort necessary for the implementation of a CDM/PPM system for speech transmission. One very attractive feature is the absence of any synchronization within the system, similar to frequency division multiplexing with AM

and incoherent reception, but with the properties of CDM and the resulting advantages in some applications. A.R.H.

N79-31490# Lincoln Lab., Mass. Inst. of Tech., Lexington.
A TERMINAL ACCESS CONTROL SYSTEM FOR FLEETSAT
Steven L. Bernstein *In* AGARD Digital Commun. in Avionics Jun. 1979 9 p refs Sponsored by Navy (For primary document see N79-31458 22-32)
Avail: NTIS HC A20/MF A01

The terminal access control system (TACS) utilizes time division multiple access (TDMA) to derive several circuits from each of the several 25 kHz wide frequency channels available. Access to these circuits is controlled in real-time by a master control station according to user demand; thus TACS is an example of a demand-assigned multiple access (DAMA) system. The access control techniques and efficiency of performance is described. In order to verify system performance predictions, a master control station and mobile platform subscriber unit were constructed and used in an extensive test program. A.R.H.

N79-31491# Mitre Corp., Bedford, Mass.
IMPLEMENTING JTIDS IN TACTICAL AIRCRAFT
David R. McMillan *In* AGARD Digital Commun. in Avionics Jun. 1979 13 p (For primary document see N79-31458 22-32)
Avail: NTIS HC A20/MF A01

The implementation of a high capacity, secure, jam-resistant time division multiple access information system for providing integrated communications, navigation, and identification capabilities is discussed. Major characteristics of the joint tactical information distribution system (JTIDS) in tactical aircraft are summarized and relevant elements of the JTIDS program plan are highlighted. The context for specific requirements to be satisfied with aircraft installations are established in terms of operational functions, sources and sinks of information which support those functions, and current information distribution systems and man-machine interfaces which mechanize the transfer to and from tactical aircraft and their crews. The relative benefit of JTIDS over present solutions to operational information needs is established in this context. An overview of key elements of the tactical aircraft implementation challenge is included. A.R.H.

N79-31492# Rome Air Development Center, Griffiss AFB, N.Y.
TDMA FOR RELAYED COMMUNICATIONS
D. L. Baerwald *In* AGARD Digital Commun. in Avionics Jun. 1979 11 p refs (For primary document see N79-31458 22-32)
Avail: NTIS HC A20/MF A01

The use of time division multiple access (TDMA) as a means of sharing the available communication resources of a communication relay, either orbital or otherwise elevated is discussed. The different forms of time-shared communications are reviewed and the impact of TDMA operation on other aspects of the communications system's performance such as flexibility, interoperability, anti-jam capability, and equipment economics is examined. A breadboard TDMA/ANSAR (Adaptive Null Steering Array Relay) system is described. The relay provides both temporal and spatial adaptive processing to maximize the ratio of recognized desired energy to unrecognized interfering energy. It performs the processing on a pulse-to-pulse basis as each user accesses it during an assigned time slot. In the system developed, each modem synchronizes its clock with that of the relay. This is critical to the rapid processing required of the relay. A.R.H.

N79-31493# Societe le Materiel Telephonique, Boulogne-Billancourt (France).
A NETWORK OF DIGITAL RADIO COMMUNICATION BY TIME DIVISION DUPLEXING [RESEAU DE RADIOCOMMUNICATION NUMERIQUE EN DUPLEX TEMPOREL]
J. Lautier *In* AGARD Digital Commun. in Avionics Jun. 1979 11 p In FRENCH (For primary document see N79-31458 22-32)
Avail: NTIS HC A20/MF A01

Until the present, the establishment of digital duplex radioelectric links required the use of two frequencies, one for transmission and the other for reception. Time division duplexing now permits the use of a single carrier frequency which automatically provides for transmission at one time and for reception at another. The user, however, can speak and listen simultaneously. The delta modulation used for digitization is particularly adapted to digitizing communication.
Transl. by A.R.H.

N79-31494# Ruhr Univ., Bochum (West Germany). Inst. fuer Elektronik.
A MULTI-GBIT/S RZ-FORMAT DIODE MULTIPLEXER
Udo Barabas *In* AGARD Digital Commun. in Avionics Jun. 1979 13 p refs (For primary document see N79-31458 22-32)
Avail: NTIS HC A20/MF A01

A clocked multiplexer circuit was realized which provided 4.48 Gbit/s, 5 Gbit/s, and 7.84 Gbit/s output-pulse streams for PCM-type input tributaries at 1.22 Gbit/s, 0.25 Gbit/s, and 1.22 Gbit/s, respectively. The circuit employed essentially modified ultra-broadband hybrid tees, step-recovery diodes, and GaAs Schottky-barrier diodes. Output voltages up to 2 V were obtained across a load of 50 omega. The pulse of the output pulses was approximately 100 ps. Author

N79-31495# Rome Air Development Center, Griffiss AFB, N.Y.
A 16 Kb/s MODEM FOR SECURE VOICE SERVICE OVER NARROWBAND ANALOG CHANNELS
Richard A. Northrup, T. R. Losson, D. D. McRae, and F. A. Perkins *In* AGARD Digital Commun. in Avionics Jun. 1979 13 p refs Prepared in cooperation with Harris Corp., Melbourne, Fla. (For primary document see N79-31458 22-32)
Avail: NTIS HC A20/MF A01

The development, testing, and planned applications of the 16 Kbps modem which operates over unconditioned 4 kHz voice frequency channels are discussed. The modem transmitter, receiver, automatic equalizer, and unique stored program processor are described as well as their operation in both the training mode and data transmission mode. A comprehensive test program of the model operating at both 16 and 8 Kbps over the worldwide dialed-up circuits of the U.S. automatic voice network (AUTOVON) is described along with a summary of the test results. Based upon the successful test performance, planned applications for the modem are inexpensive 16 Kbps continuous variable slope delta moculation (CVSD) secure digital voice transmission, and the 8 Kbps transmission of high quality data or imagery over dialed-up narrowband circuits. An alternate secure digital voice application is 32 Kbps CVSD, whereby a biplexer device splits the 32 Kbps into two 16 Kbps streams for transmission by the 16 Kbps modem over two separate channels. A.R.H.

N79-31496# Politecnico di Torino (Italy). Inst. di Elettronica e Telecommunicazioni.
DOUBLE DIFFERENTIAL PSK SCHEME IN THE PRESENCE OF DOPPLER SHIFT
Mario Pent *In* AGARD Digital Commun. in Avionics Jun. 1979 11 p refs (For primary document see N79-31458 22-32)
Avail: NTIS HC A20/MF A01

A double differentially coherent demodulation scheme (DDPSK) is proposed for digitally phase modulated signals: its performance is theoretically independent on slow carrier frequency fluctuations and this result is obtained by means of a very simple and reliable structure. The theoretical analysis of the ideal DDPSK shows that, in the absence of carrier frequency shift, it suffers a penalty of about 4 dB with respect to the conventional DCPSK demodulation scheme. Since the potential applications of such a demodulation scheme are in the field of the air-to-air or air-to-ground data links, a comparative analysis was made with respect to the conventional DCPSK in the presence of a carrier frequency shift, and the conditions are derived (in terms of carrier frequency, relative speed and information rate) under which the DDPSK performs better. Author

N79-31649# Appleton Lab., Slough (England).
EISCAT
H. Rishbeth *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 85-94 refs (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N79-31497 British Library Lending Div., Boston Spa (England).
THE HARMFUL EFFECTS OF BEARING CURRENTS AND WAYS OF SUPPRESSING THEM
F. Novy May 1979 16 p refs Transl. into ENGLISH from Elektrotech. Obz. (Czechoslovakia), v. 55, no. 5, 1966 p 239-242
(BLL-RTS-11672) Avail: British Library Lending Div., Boston Spa, Engl.

The occurrence of bearing currents on the bearings and other components of synchronous, asynchronous, and DC motors is examined. Precaution against bearing currents using lubricating oils, compensating coils, and insulation is discussed. A.W.H.

N79-31498*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ELECTRICAL SHORT LOCATOR Patent Application
Gordon J. Deboo and David Joseph Devine, inventors (to NASA) Filed 24 Aug. 1979 12 p
(NASA-Case-ARC-11116-1; US-Patent-Appl-SN-069485) Avail: NTIS HC A02/MF A01 CSCL 09A

An electrical short finding instrument suited for locating shorts as they occur while an electrical system is being wired, sounds an alarm as soon as a short is produced and further identifies the conductors that are shorted together. A ring counter derives input pulses from a squarewave oscillator. The outputs of the counter are fed through transistors to an array of light emitting diodes. Each diode is connected to an electrical conductor, such as a bus bar, that is to be tested. Leads and connector permit such connections to be made to the bus bar assembly. In the absence of a short between two electrical conductors the diodes are sequentially illuminated. When a short occurs, a comparator/multivibrator circuit triggers an alarm and stops the oscillator and the sequential energization of the diodes. The two diodes that remain illuminated identify the bus bars that are shorted. NASA

N79-31499*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYTICAL CORE LOSS CALCULATIONS FOR MAGNETIC MATERIALS USED IN HIGH FREQUENCY HIGH POWER CONVERTER APPLICATIONS Ph.D. Thesis - Toledo Univ.
James E. Triner Aug. 1979 103 p refs
(NASA-TM-79234; E-9993) Avail: NTIS HC A06/MF A01 CSCL 09A

The basic magnetic properties under various operating conditions encountered in the state-of-the-art DC-AC/DC converters are examined. Using a novel core excitation circuit, the basic B-H and loss characteristics of various core materials may be observed as a function of circuit configuration, frequency of operation, input voltage, and pulse-width modulation conditions. From this empirical data, a mathematical loss characteristics equation is developed to analytically predict the specific core loss of several magnetic materials under various waveform excitation conditions. G.Y.

N79-31500# Army Armament Research and Development Command, Dover, N. J. Management Information Systems Directorate.
A FINITE-DIFFERENCE FORMULATION OF THE MAGNETIC VECTOR POTENTIAL Interim Report
William A. Bussom Apr. 1979 60 p refs
(AD-A070495; AD-E400310; ARMID-MR-78001) Avail: NTIS HC A04/MF A01 CSCL 20/3

This interim report represents the first phase in the investigation of the computer analysis of nonlinear electromagnetic circuits using magnetic field vector quantities. The finite difference method is formulated and boundary conditions are discussed. Solution procedures are stated. GRA

N79-31501# Naval Research Lab., Washington, D. C.
A BROAD-BAND PASSIVE-REDUNDANT UHF AMPLIFIER CIRCUIT
D. C. Rohlfs, R. E. Garback, and B. N. Navid 8 May 1979 33 p
(ZF12151001)
(AD-A069325; NRL-MR-3997) Avail: NTIS HC A03/MF A01 CSCL 09/5

A Passive-Redundant UHF amplifier circuit which acts as its own fault sensor and automatically adjusts and compensates for individual amplifier degradation is described. It is essentially a parallel circuit, operating to maintain a constant output, whether one amplifier fails completely or both degrade gracefully. The circuit was designed for 435 MHz and tested for operation over the frequency range of 400 to 470 MHz. It is suitable for use in stages of a system where power transfer is not critical. GRA

N79-31502# Air Force Avionics Lab., Wright-Patterson AFB, Ohio.
NEW TECHNIQUES FOR TRACKING SEQUENCES OF DIGITIZED IMAGES Final Report Ph.D. Thesis
Llewellyn S. Dougherty Feb. 1979 214 p refs
(AD-A069996; AFAL-TR-79-1015) Avail: NTIS HC A10/MF A01 CSCL 09/4

In Chapter 1, the research objectives are outlined, the image tracking task is defined, and the component parts of a generalized image-tracking system are discussed. Chapter 2 presents as background material a summary of applications for image tracking systems, and some classical similarity detection techniques. In Chapter 3, a two-dimensional signal-to-noise ratio is developed for minimum norm similarity detectors and an upper bound is developed and experimentally verified for the probability of error associated with a particular type of misregistration. Chapter 4 presents three techniques for enhancing the signal-to-noise ratio, Chapter 5 presents and adaptive Kalman filter which is shown to be very helpful in reducing misregistration errors, and Chapter 6 develops and analyzes the performance of an integrated tracking algorithm which incorporates a complementary set of component algorithms. Chapter 7 provides a summary of this research and some suggestions for future work. GRA

N79-31503# Rome Air Development Center, Griffiss AFB, N.Y.
THE USE OF AIR FORCE FIELD MAINTENANCE DATA FOR R AND M ASSESSMENTS OF GROUND ELECTRONIC SYSTEMS Technical Report, Jul. 1975 - Aug. 1978
Eugene Fiorentino Apr. 1979 122 p
(AF Proj. 2338)
(AD-A069920; RADC-TR-79-103) Avail: NTIS HC A06/MF A01 CSCL 09/5

This report presents the results of a study on the use of Air Force field maintenance data for the reliability and maintainability assessment of operational ground electronic equipments. A currently operational relatively complex ground electronic equipment was used as a study vehicle. Comparisons are made between the R and M estimates derived from the field data versus similar estimates obtained from the R and M design and development program. The study identifies the major limitations in the field data for use in field R and M assessment. Recommendations for improving the quality and usability of the field data are also made. Author (GRA)

N79-31504# Hydrotronics, Inc., San Diego, Calif.
PERFORMANCE OF THE ADAPTIVE NOISE CANCELLER WITH A NOISY REFERENCE: NON-WIENER SOLUTIONS Final Report, Sep. 1978 - Feb. 1979
M. Shensa 15 Mar. 1979 25 p refs
(Contract N00123-78-C-1005)
(AD-A069825; NOSC-TR-381) Avail: NTIS HC A02/MF A01 CSCL 09/3

This report is a reliability and maintainability design guide for helicopter drive systems. While not containing 'how to' design information, the guide points out those areas of design which can be troublesome in the reliability and maintainability of helicopter drive systems. Besides containing information on the various drive system components, a management section is included that outlines some practices which design managers may employ to insure that reliability and maintainability are given proper emphasis during a design program. The final section is

devoted to a step-by-step procedure for hazard function analysis, which may be used to predict the reliability of a gearbox during the design stage. GRA

N79-31505# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SOLID-STATE dc SWITCH
A. R. Millner 6 Mar. 1979 14 p
(Contract EY-76-C-02-4094)
(COO-4094-36) Avail: NTIS HC A02/MF A01

The design of a low cost dc solid state relay with logic-compatible input to be used for photovoltaic applications is described. Emphasis during the development of this unit was placed on cost, power level, dissipation, switching speed, and the modularity of photovoltaic systems. The design details of the switch, schematics, specifications, and test waveforms are also described. DOE

N79-31506# Los Alamos Scientific Lab., N. Mex.
SINGLE-CAVITY DOUBLE-FREQUENCY BUNCHER
S. O. Schriber and D. A. Swenson 1979 16 p refs Presented at the Particle Accelerator Conf., San Francisco, 12-14 Mar. 1979
(Contract W-7405-eng-36)
(LA-UR-79-686; Conf-790327-16) Avail: NTIS HC A02/MF A01

A single-cavity buncher was developed that resonates at both the fundamental and twice the fundamental frequency to form a more nearly ideal bunching voltage waveform in the gap. The cavity utilizes the TM sub 020-like mode as the first harmonic of the fundamental TM sub 010-like mode. Field distributions on or near the axis are essentially identical for the two modes. Many beam bunching applications require two bunchers with the harmonic buncher being physically as close as possible to the fundamental frequency buncher; the buncher described accomplishes this property with a single cavity and excitation of two modes. Means of tuning and fabrication are described. A geometry chosen for PIGMI is described in more detail. DOE

N79-31507# Los Alamos Scientific Lab., N. Mex.
DC SUPERCONDUCTING POWER TRANSMISSION LINE PROJECT AT LASL: US DOE DIVISION OF ELECTRIC ENERGY SYSTEMS Progress Report, 1 Oct. 1977 - 30 Sep. 1978
F. J. Edeskuty, comp. and N. N. Sheheen, comp. Mar. 1979 154 p refs
(Contract W-7405-eng-36)
(LA-7707-PR; PR-23) Avail: NTIS HC A08/MF A01

An annual progress report of the Los Alamos Scientific Laboratory dc Superconducting Power Transmission Line (SPTL) development project covering the period October 1977 to September 1978 is presented. Progress is described in the electrical engineering, cryogenic engineering, and superconductor design for a 100 kV, 5 GW at 50 kA dc SPTL. DOE

N79-31508# Sandia Labs., Albuquerque, N. Mex.
TRANSFER MOLDING OF FLAT FLEXIBLE CABLE TERMINATIONS
G. Voida Sep. 1978 37 p refs
(Contract EY-76-C-04-0789)
(SAND-78-0801) Avail: NTIS HC A03/MF A01

The use of two different transfer molded powdered epoxy compounds for sealing of flat, flexible cables which were laminated with acrylate adhesive is described. One of the molding compounds was mineral filled and the other was glass fiber filled. Transfer molding was successfully employed without impairment to the thin polyimide cable strip, to the soldered connections, or to the plastic molded rack and panel type connectors. Cables potted with polyurethane potting resin were used as controls. The molding process and test results are reported. DOE

N79-31509# Sandia Labs., Albuquerque, N. Mex.
EXTENSION OF HIGH TEMPERATURE ELECTRONICS
B. L. Draper and D. W. Palmer 1979 18 p refs Presented at the 29th Electron. Components Conf., Cherry Hill, N.J., 14 May 1979
(Contract EY-76-C-04-0789)
(SAND-79-0388C; Conf-790506-3) Avail: NTIS HC A02/MF A01

Commercial and Sandia fabricated silicon MOSFETs, thick film resistor and dielectrics, and magnetic components were investigated in an effort to increase the versatility of microelectronics used at 300 C and to form a foundation for a higher temperature technology. Commercial MOSFETs were found susceptible to parameter drifts when aged at 300 C, whereas special low alkali impurity devices were able to sustain operation at 300 C for 1000 hours without drift. Thus, although MOSFET are prone to aging, it is possible to use fabrication procedures which allow MOSFET use at high temperature. DOE

N79-31510# Los Alamos Scientific Lab., N. Mex.
LOSSES IN SUPERCONDUCTING MULTIFILAMENT COMPOSITES UNDER ALTERNATING CHANGING FIELDS
B. Turck Mar. 1979 33 p refs
(Contract W-7405-eng-36)
(LA-7639-MS) Avail: NTIS HC A03/MF A01

A brief review of the losses in superconducting composites in a changing external field is presented. The losses are expressed for a single triangular shaped pulse and for a field varying exponentially with time. The case of an oscillating sinusoidal field is considered. In particular, in a rapidly varying field, several layers of filaments can be saturated by returning currents. Complete expressions of the losses are provided together with simplified expressions. A comparison between several kinds of conductors shows that in some cases the losses are reduced by increasing the twist pitch of the conductor. DOE

N79-31511# Societe Europeene de Propulsion, Vernon (France). Dept. Espace.
INVESTIGATIONS OF SURFACE POTENTIAL MEASUREMENTS Final Report
Joly, Maincent, Rouhet, and Valentian 10 Jul. 1978 139 p
(Contract ESTEC-3420/77-NL-MP)
(ESA-CR(P)-1189) Avail: NTIS HC A07/MF A01

Surface electrostatic voltage measurements onboard satellites can be made using various types of detectors. Mechanical, electro-optical, and semiconductor detectors were studied. Detectors examined include a rotating arm detector, an oscillating arm detector, a vibrating capacitor, an electron beam deviation dectector, a Pockel effect detector, and an Insulated gate field effect transistor (IGFET). Three types of detectors (vibrating capacitor, Pockel effect, and (IGFET) were selected. This last type is divided into two subtypes, an IGFET acting as a capacitive voltage divider and a thick gate IGFET. Tests show that the IGFET can be easily destroyed by voltages as low as 1500 V and that it is subject to thermal drift as well as drift under constant voltage. The Pockel effect detector also shows performance deficiencies. Of the three detector types investigated the vibrating capacitor was retained for development as the feasibility of using existing flight hardware was shown. It is suggested that a second generation of IGFET's and Pockel effect detectors also be developed in parallel. Author (ESA)

N79-31512# AEG-Telefunken, Wedel (West Germany). Abt. Raumfahrt-Elektronik.
ASSESSMENT OF SHORT AND MEDIUM TERM IMPROVEMENTS TO THE SPACELAB POWER SYSTEM. VOLUME 1: EXECUTIVE SUMMARY
26 Oct. 1978 39 p 2 Vol.
(Contract ESA-3538/78-F-HEW(SC))
(ESA-CR(P)-1193-Vol-1) Avail: NTIS HC A03/MF A01

The results of a study for the improvement of Spacelab's baseline electrical power and distribution system (EPDS) are presented. Three technical areas are covered. These are improvement of baseline-EPDS hardware, the introduction of an additional power source for experiment power augmentation, and the replacement of the baseline EPDS 3 phase 400 Hz ac distribution system by a medium frequency (10 to 20 KHz) ac power distribution system. The improvements include a dc/ac inverter, an experiment power switching panel, a power control box, harness improvements, a medium frequency ac power system, dc/ac medium frequency inversion, and medium frequency ac power distribution, switching, and protection. Author (ESA)

N79-31513# AEG-Telefunken, Wedel (West Germany). Abt. Raumfahrt-Elecktronik.

ASSESSMENT OF SHORT AND MEDIUM TERM IMPROVEMENTS TO THE SPACELAB POWER SYSTEM
26 Oct. 1978 56 p 2 Vol.
(Contract ESA-3538/78-F-HEW(SC))
(ESA-CR(P)-1193-Vol-2) Avail: NTIS HC A04/MF A01

The results of a study to improve Spacelab's baseline electrical power and distribution system (EPDS) are presented. An additional 3 kW power source for experiment power augmentation is discussed, including the analysis of fuel cell kits as add-on power modules. A solar array subsystem, technical descriptions, and a cost/schedule assessments are also discussed. Author (ESA)

N79-31514# Laboratoires d'Electronique et de Physique Appliquee, Limeil-Brevannes (France).
FEASIBILITY STUDY CONCERNING SCREEN OPACITY AS WELL AS THE CURVE OF THE MICROCHANNELS IN A 40mm CHANNEL MULTIPLIER RELATIVE TO APPLICATIONS IN A PHOTOMULTIPLIER TUBE Final Report [ETUDE DE LA FAISABILITE DE L'OPACITE DE L'ECRAN ET DE LA COURBURE D'UNE GALETTE DE MICROCANAUX DE 40mm DE DIAMETRE EN VUE D'UNE APPLICATION POUR UN TUBE INTENSIFICATEUR A COMPTAGE DE PHOTONS]
J. C. Rosier, V. Duchenois, and E. Desvaux Dec. 1978 54 p In FRENCH
(Contract ESTEC-3307/NL-AK(SC))
(SME/78.648/659I; ESA-CR(P)-1195) Avail: NTIS HC A04/MF A01

Relative to the improvement of the performance characteristics of the photon detector sub-assembly and the faint object camera to be used on the NASA space telescope, a photomultiplier tube was studied. Results include the improvement of the imaging screen by increasing the opacity of the aluminum membrane which covers the luminophor of the screen. A channel multiplier with curved microchannels was also developed in order to optimize the gain in electron multiplication afforded by increased screen opacity. The deposition processes used in fabricating the screen are discussed for the various schemes investigated. Tests and results for both the screen and channel multiplier are detailed. Author (ESA)

N79-31515# Sira Inst. Ltd., Chislehurst (England).
EVALUATION OF LINEAR SELF-SCANNING IMAGING ARRAYS Final Report
D. J. Purll and J. A. Smith Jan. 1979 220 p
(Contract ESTEC-3414/77)
(SIRA-6/5071/00; ESA-CR(P)-1197) Avail: NTIS HC A10/MF A01

Some properties of linear charge coupled devices (CCD) and photodiode imaging arrays were investigated. Four properties were tested, namely the aperture response of individual elements, response nonuniformity, dark current nonuniformity, and readout noise. Information was sought principally for future progress of the High Accuracy Sun Sensor project, but is expected to be useful in other applications, such as earth imaging from space. Seven devices were tested: GEC MA338X; Reticon CCPD 1024, CCPD 256, RL 256G and RL 256 C17; and Fairchild CCD 131 and CCD 110F. The above-mentioned properties were tested where appropriate under variable conditions of light color, light level, integration time, and temperature. Aperture responses of individual elements were mapped by scanning a small spot of light across the elements. For a particular array and light color the aperture responses were found to be very repeatable along the array, and no irregularities apart from those due to dirt were found. Interpolation of positional information of an accuracy of much better than the element spacing is therefore possible, using error techniques between adjacent elements or element groups. Cross-talk was found to increase with wavelength as expected. Noise measurements suggest that if noise equivalent signals of around 100 to 200 electrons are required, only Fairchild arrays can be used of those commercially available. Other CCD and CCPD arrays have noise around an order of magnitude lower than the photodiode arrays which were tested. Author (ESA)

N79-31516# Thomson-CSF, Velizy (France). Div. Tubes Electroniques.
DEVELOPMENT OF AN IMPROVED CARCINOTRON IN THE FAR INFRARED RANGE Final Report
G. Kantorowicz Mar. 1979 57 p
(Contract ESTEC-3294/77-NL-AK)
(TR-2091-T; ESA-CR(P)-1202) Avail: NTIS HC A04/MF A01

The improvement of a Carcinotron (Backward Wave Oscillator) working around a wavelength of 0.85 mm 20 percent tunability range is discussed. A gun was designed in order to increase the tuning bandwidth and the tube was tested with a lighter Samarium-Cobalt magnet. The tuning range achieved was increased by a factor of 1.35 as compared to the previous tube measurements inside a conventional Ticonal magnet and is comparable to the range measured when operating a previous model with an electromagnet. The mass of the magnet was reduced by a factor of three by use of the Samarium-Cobalt magnet. Author (ESA)

N79-31517# Fabrica Italiana Apparecchi Radio S.p.A., Milan (Italy).
EVALUATION OF EPSILAM-10 MIC SUBSTRATE MATERIAL
P. L. Faja, C. Scotti, and M. Ronsisvalle Dec. 1978 135 p
(Contract ESTEC-3153/77)
(FIAR-SA0347; ESA-CR(P)-1203) Avail: NTIS HC A07/MF A01

The suitability of the EPSILAM-10 material as substrate for microwave microstrip circuits, taking into account the anisotropy in the dielectric constant, is studied. As a theoretical tool, a computer program for the calculation of line impedances was used. To evaluate the application of the material 50 ohm lines, coupled lines directional couplers, hybrid type power dividers, and class-C transistor power amplifiers were designed, manufactured and tested. The main conclusion is that the material is suitable for use in microwave microstrip applications, where high tolerances are not mandatory (e.g. for transistor matching networks or couplers to be used in signal samplers). Author (ESA)

N79-31518# Thomson-CSF, Velizy (France). Div. Tubes Electroniques.
AN ACOUSTIC WAVE OSCILLATOR FUNCTIONING IN THE 1.5 GHz RANGE Final Report [OSCILLATEUR A ONDES ACOUSTIQUES FONCTIONNANT AU VOISINAGE DE 1.5 GHz]
Y. Charlet Feb. 1979 71 p refs In FRENCH
(Contract ESTEC-3149/77-NL-AK(SC))
(TR-2056-T; ESA-CR(P)-1204) Avail: NTIS HC A04/MF A01

Two surface acoustic wave oscillators, each consisting of a free transistor oscillator phase locked with a reflective array of acoustic delay lines, were built and studied in order to develop a local oscillator suitable for use in a model of a satellite repeater. The performance characteristics of the as-built device were also compared with existing oscillator, notably a quartz oscillator, a cavity stabilized oscillator, and a phased oscillator. Of the breadboard phase locked oscillator, one has an output power of 100 mW with a short term stability of eight nano/sec, an AM noise level -60dB, and an acceptable FM noise spectra. The second has a short term stability of two nano/sec for an output power of 50 mW, the other characteristics being analogous to the first. Author (ESA)

N79-31519# Etudes Techniques et Constructions Aerospatiales, Charleroi (Belgium).
A STUDY OF ADVANCED POWER SUPPLIES Final Report
A. Poncin and C. Rym Jan. 1979 81 p
(Contract ESTEC-3386/77-NL-HP(SC))
(LAB-79-22; ESA-CR(P)-1220) Avail: NTIS HC A05/MF A01

Different approaches to the problem of satellite power supply were studied from a modular systems point of view in order to define a new generation of flexible, low cost power supplies. As a secondary goal, an increase in the competitiveness of European industry in this field is intended. Four different satellite application payloads were reviewed and from their requirements various subsystem configurations are proposed. Areas where the maximum reuse of hardware can be achieved were also identified. Results comprise the definition of each configuration for each mission to modular level, a schematic for each modular type, and preliminary specifications for these modules. Author (ESA)

N79-31520# British Aerospace Dynamics (Space), Stevenage (England).
THE CIRCUITS DESIGN OF A SATELLITE BATTERY DISCHARGE REGULATOR USING THE LIMIT CYCLE CONDUCTANCE CONTROLLER Final Report
P. J. Higgins Mar. 1979 86 p
(Contract ESA-3376/77-NL-HP)
(TP-7725; ESA-CR(P)-1223) Avail: NTIS HC A05/MF A01

The design of a battery discharge regulator (BDR) module incorporating the principle of limit cycle conduction control is described. The design aim was to produce an improved BDR module compatible with the European Communications Satellite (ECS) power system. A complete design is presented here with circuit diagrams, parts lists, and test results. Due account was taken of parts derating and reliability considerations as befitting a flight standard design. During the design process the principle advantages of limit cycle conduction control were confirmed and some disadvantages were discovered. While not meeting all requirements of the target specification, the result is a working BDR module having similar performance to the ECS circuit, but with nominally twice the power handling capability for a given mass. Author (ESA)

N79-31521# National Technical Information Service, Springfield, Va.
MICROWAVE OSCILLATORS, VOLUME 3. CITATIONS FROM THE NTIS DATA BASE Progress Report, Apr. 1976 - Mar. 1979
William E. Reed May 1979 257 p Supersedes NTIS/PS-78/0333; NTIS/PS-77/0299; NTIS/PS-76/0312; NTIS/PS-75/325
(NTIS/PS-79/0414/7; NTIS/PS-78/0333; NTIS/PS-77/0299; NTIS/PS-76/0312; NTIS/PS-75/325) Avail: NTIS HC $28.00/MF $28.00 CSCL 09E

This bibliography cites 250 research reports on the design, development, and application of microwave oscillators. The reliability and radiation effects of these oscillators is presented. GRA

N79-31522# National Technical Information Service, Springfield, Va.
GUNN EFFECT AND TRANSFERRED ELECTRON DEVICES, VOLUME 2. CITATIONS FROM THE NTIS DATA BASE Progress Report, May 1977 - May 1979
William E. Reed Jun. 1979 89 p Supersedes NTIS/PS-78/0361; NTIS/PS-77/0255; NTIS/PS-76/0271 and NTIS/PS-75/227 2 Vol.
(NTIS/PS-79/0598/7; NTIS/PS-78/0381; NTIS/PS-77/0255; NTIS/PS-76/10271; NTIS/PS-75/227) Avail: NTIS HC $28.00/MF $28.00 CSCL 09A

Federally-sponsored research reports on the application of Gunn effect and transferred electron devices to microwave generation, amplification, and control are presented. The Gunn effect in semiconductors is discussed. The design, fabrication, and properties of Gunn diodes and transferred electron devices are included. (This updated bibliography contains 83 abstracts, 19 of which are new entries to the previous edition.) GRA

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N79-31523* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THERMAL CONTROL CANISTER Patent
Stanford Ollendorf, inventor (to NASA) Issued 31 Jul. 1979 11 p Filed 21 Nov. 1977 Supersedes N78-13380 (16 - 04 p 0474)
(NASA-Case-GSC-12253-1; US-Patent-4,162,701; US-Patent-Appl-SN-853677; US-Patent-Class-165-32; US-Patent-Class-165-105; US-Patent-Class-244-1R; US-Patent-Class-244-163) Avail: US Patent and Trademark Office CSCL 20D

An apparatus for maintaining a heat dissipating load at a substantially constant temperature, and more particularly, to such an apparatus where in variable conductance heat pipes control the radiating area of a radiator is described.
Official Gazette of the U.S. Patent and Trademark Office

N79-31524# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany).
CONTRIBUTIONS TO FLUID MECHANICS [BEITRAEGE ZUR STREMUNGSMECHANIK]
1978 184 p refs In GERMAN
Avail: NTIS HC A09/MF A01

Ten articles are presented which cover a wide spectrum of research in the field of theoretical and experimental fluid mechanics. The titles of the articles are: (1) Development of Data Acquistition and Processing Systems for a 3 mm Wind Tunnel; (2) Airfoil Lift in Compressible Subsonic Flow with Separation; (3) Sound Generation in an Induction Motor Fan; (4) The Hypersonic Vacuum Tunnel; (5) Remarks on a Hydraulic Ram; (6) Experimental and Theoretical Pressure Distribution on the Ellipsoid of Revolution; (7) Theoretical Study of the Effect of the Pressure Fluctuation Component in Three Dimensional Turbulent Boundary Layers; (8) Variations of a Parallel Flow Along a Flat Plate Due to a Normally Directed Free Jet; (9) Effects of Solid Boundary Surface in a Flow about a Profile with Separation; and (10) Introduction to the Electronic Data Processing to Improve Cataloging in the Library of the Aerodynamic Testing Facilities in Goettingen. G.Y.

N79-31525# Southampton Univ. (England). Dept. of Aeronautics and Astronautics.
A STUDY OF COHERENT STRUCTURES IN AXISYMMETRIC JETS USING AN OPTICAL TECHNIQUE
Gautam T. Kalghatgi Jun. 1979 40 p refs Backup document for AIAA Synoptic scheduled for publication in AIAA Journal in March, 1980
(AASU-341; Log-J11122) Avail: NTIS HC A03/MF A01

An optical method using the deflection of laser beams caused by density gradients in the flow was used to study coherent structures in the first six diameters of five axisymmetric jets of different velocities and densities. Quantitative information about the development of the coherent structures with axial distance was deduced and is presented in terms of the average interval between successive events, the convection velocity, and the chances of survival of individual events. It was found that coherence decreases and the average interval between successive events increases with increasing axial distance. The average convection velocity of the structures increases with axial distance initially and reaches a somewhat steady value beyond two diameters. It is shown that the most numerous interactions occur in the region before one nozzle diameter. K.L.

N79-31526*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FREE JET PHENOMENA IN A 90 DEGREE-SHARP EDGE INLET GEOMETRY
R. C. Hendricks 1979 30 p refs Presented at Intern. Cryogenic Engr. Conf. and the Intern. Cryogenic Materials Conf., Madison, Wis., 21-24 Aug. 1979; sponsored by NBS
(NASA-TM-79229; E-131) Avail: NTIS HC A03/MF A01 CSCL 20D

Under certain conditions, inlets with a sharp edge or geometric corner were shown to exhibit sufficiently strong separation effects to permit the working fluid to flow through the duct as if it were a free jet. Mass limiting flow data and associated pressure profiles for tubes of 53, 64, 73, and 105 length/diameter with a 90 deg sharp edge or orifice type inlet were taken and compared to Borda type inlet data to determine bounds of the free jet phenomena. For smooth tubes the limits appear to be one dimensional and dependent only on inlet stagnation conditions. Similar free jet effects were found for fluid hydrogen indicating that fluid jetting may common to all fluids flowing through 90 deg sharp edge inlet geometries. Author

N79-31527*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

A REDUCED VOLUMETRIC EXPANSION FACTOR PLOT
R. C. Hendricks 1979 29 p refs Presented at Cryogenic Engr. Conf. and the Intern. Cryogenic Materials Conf., Madison, Wis., 21-24 Aug. 1979
(NASA-TM-79240; E-148) Avail: NTIS HC A03/MF A01 CSCL 20D

A reduced volumetric expansion factor plot was constructed for simple fluids which is suitable for engineering computations in heat transfer. Volumetric expansion factors were found useful in correlating heat transfer data over a wide range of operating conditions including liquids, gases and the near critical region. G.Y.

N79-31528*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A NAVIER-STOKES FAST SOLVER FOR TURBULENT MODELING APPLICATIONS
J. D. Murphy and M. W. Rubesin Aug. 1979 19 p refs Presented at AGARD Conf. on Turbulent Boundary Layers: Expt., Theory, and Modeling, Hague, 25-26 Sep. 1979
(NASA-TM-78612; A-7936) HC A02/MF A01 CSCL 20D

A computer program for the solution of the steady Reynolds averaged incompressible Navier-Stokes equations that can accept a variety of turbulence closure models is described. The program is sufficiently accurate and economical to permit extensive comparisons with mean moment data from experiment and should provide a useful tool to the turbulence modeler because of the generality of the models which can be considered and the economy with which solutions can be obtained. Focus is on 0, 1, and 2 equation closure models and the computed results are compared with experiment and with results of boundary-layer calculation using the same models. These comparisons show that flow parameters which are sufficiently severe to provide strong tests of higher order closure models are also sufficiently severe as to cast doubt on the results based on classical boundary-layer calculations. To demonstrate the accuracy and speed of the program, parametric studies are presented which show the effects of both purely numerical considerations, such as mesh size, convergence criteria, boundary location, etc., and physical consideration such as boundary conditions, etc. It is believed that the present computer code is more general than previously available fast solvers. No near-wall equilibrium assumptions have to be made, as both the mean flow and turbulence closure relations are integrated all the way to the wall. A.R.H.

N79-31529# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
TURBULENT BOUNDARY LAYERS. PART 2: CALCULATION OF BOUNDARY LAYER DEVELOPMENT USING THE TURBULENT ENERGY EQUATION
P. Bradshaw (Natl. Phys. Lab., Engl.) Mar. 1968 73 p refs Lecture held at Rhode-Saint-Genese, Belgium, 4-15 Mar. 1968 3 Vol.
(VKI-Lecture-Series-5-Pt-2) Avail: NTIS HC A04/MF A01

Details are given of one of a family of prediction methods, based on the hypothesis that the relations between the turbulent shear stress and the other properties of the turbulence are sufficiently universal to be represented for engineering purposes by functions of only a few parameters. It is suggested that this hypothesis is a better approximate than the hypothesis of universal relations between the turbulent shear stress and the mean velocity profile. Mixing length theory is shown to be a special cased of the prediction method described. K.L.

N79-31530# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
MECHANICS OF BOUNDARY LAYER TRANSITION, PART 2: INSTABILITY AND TRANSITION TO TURBULENCE
Mark V. Morkovin (Martin Co., Baltimore, Md.) Feb. 1968 176 p refs Lecture held at Rhode-Saint-Genese, Belgium 3 Vol.
(VKI-Lecture-Series-3-Pt-2) Avail: NTIS HC A09/MF A01

Instability and transition from laminar to turbulent shear layers is discussed. Topics include advances in understanding the transition and contradictions in transition research. Transition correlations for hypersonic wakes, three dimensional boundary layers, laminar suction wings, heat transfer and boundary layer transition, and Reynolds number effects are covered. For individual title, see N79-31531.

N79-31531# Martin Co., Baltimore, Md.
THE TRANSITION PUZZLEMENT REVISITED
Mark V. Morkovin *In* Von Karman Inst. for Fluid Dyn. Mech. of Boundary Layer Transition, Pt. 2 Feb. 1968 9 p refs (For primary document see N79-31530 22-34)
Avail: NTIS HC A09/MF A01

Paradoxes in research on transition from laminar to turbulent shear layers are pinpointed. The need for focusing on the probable nonuniqueness of the transition, accounting for disturbances in the system, and recognizing a philosophy of design involving transition is emphasized. K.L.

N79-31532# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
MECHANICS OF BOUNDARY LAYER TRANSITION, PART 3: INSTABILITY AND TRANSITION TO TURBULENCE (OUTLINE OF CONCEPTS)
Mark V. Morkovin (Martin Co., Baltimore, Md.) Feb. 1968 94 p refs Lecture held at Rhode-Saint-Genese, Belgium 3 Vol.
(VKI-Lecture-Series-3-Pt-3) Avail: NTIS HC A05/MF A01

Concepts on instability and transition from laminar to turbulent shear layers are outlined. The concepts include low speed pressure gradients, obtaining transition information from hypersonic flight tests and ballistic ranges, wakes, unsteady boundary layers, three dimensional boundary layers, surface roughness, transition reversals with cooling, and free stream turbulence correlation. K.L.

N79-31533*# Douglas Aircraft Co., Inc., Long Beach, Calif.
A NEW APPROACH TO THE SOLUTION OF LARGE, FULL MATRIX EQUATIONS: A TWO-DIMENSIONAL POTENTIAL FLOW FEASIBILITY STUDY Final Report
R. M. James and R. W. Clark Washington NASA Sep. 1979 83 p refs
(Contract NAS1-14892)
(NASA-CR-3173) Avail: NTIS HC A05/MF A01 CSCL 20D

An approach to the solution of matrix problems resulting from integral equations of mathematical physics is presented. Based on the inherent smoothness in such equations, the problem is reformulated using a set of orthogonal basis vectors, leading to an equivalent coefficient problem which can be of lower order without significantly impairing the accuracy of the solution. This approach was evaluated using a two-dimensional Neumann problem describing the inviscid, incompressible flow over an airfoil. Two different kinds of mode functions were investigated, namely eigenfunction series and Fourier series. The method using Fourier series was found preferable. It uses all of the coefficients from a Fast Fourier Transform algorithm in an approximate method which exploits the known structure of the transformed coefficient matrix and very promising results for the flow over a realistic airfoil are obtained. On the basis of the results presented here, an order of magnitude reduction in this computer time can be expected for such problems as compared with the time for a direct matrix solution. M.M.M.

N79-31534# European Space Agency, Paris (France). Hermann-Foettinger Inst. fuer Thermo- und Fluiddynamik.
CONTRIBUTIONS ON TRANSPORT PHENOMENA IN FLUID MECHANICS AND RELATED TOPICS
W. Haase, comp. Mar. 1979 455 p refs Transl. into ENGLISH from "Beitraege zu Transportphaenomenen in der Stroemungsmechanik und anverwandten Gebieten', DFVLR, Berlin Report DLR-FB-77-16, Mar. 1977 Original report in GERMAN previously announced as N79-12367 Original German report available from DFVLR, Cologne DM 95,40
(ESA-TT-498; DLR-FB-77-16) Avail: NTIS HC A14/MF A01

Experimental and theoretical investigations on thermo-fluid-dynamics, mainly boundary layer theory, Navier-Stokes equations and thermodynamics as well as process-technology and nuclear engineering are presented. For individual titles, see N79-31535 through N79-31571.

N79-31535# European Space Agency, Paris (France).
THE DOUBLE P SUB N APPROXIMATION OF THE NEUTRON TRANSPORT EQUATION IN SLAB GEOMETRY TAKING INTO ACCOUNT LINEAR ANISOTROPIC SCATTERING
Gerhard Bartsch and Ulrich Hauptmanns *In its* Contrib. on Transport Phenomena in Fluid Mech. and Related Topics (ESA-TT-498) Mar. 1979 p 7-23 refs Transl. into ENGLISH from "Beitraege zu Transportphaenomenen in der Stroemungsmechanik und anverwandten Gebieten", DFVLR, Berlin Report DLR-FB-77-16, Mar. 1977 p 7-18 Original report in GERMAN previously announced as N79-12368 (For primary document see N79-31534 22-34)
Avail: NTIS HC A14/MF A01

Extrapolation distances, collision probabilities, angular fluxes, flux rates, and critical dimensions were calculated for one-dimensional reactor problems in slab geometry using the double-p sub n-method. The influence of linearly anisotropic scattering and in special cases that of a spatially constant neutron source on these characteristics parameters was investigated.
Author (ESA)

N79-31536# European Space Agency, Paris (France).
ON THE SOLUTION OF LAMINAR FLOW OVER A CIRCULAR CYLINDER STARTED IMPULSIVELY FROM REST
Tuncer Cebeci *In* ESA Contrib. on Transport Phenomena in Fluid Mech. and Related Topics (ESA-TT-498) Mar. 1979 p 24-41 refs Transl. into ENGLISH from "Beitraege zu Transportphaenomenen in der Stroemungsmechanik und anverwandten gebieten", DFVLR, Berlin Report DLR-FB-77-16, Mar. 1977 p 19-28 Original report in German previously announced as N79-12369 (For primary document see N79-31534 22-34)
(Grant NSF ENG-74-11895)
Avail: NTIS HC A14/MF A01

A numerical method for calculating the unsteady laminar flow over a circular cylinder started impulsively from rest is presented. The governing boundary layer equations were solved using Keller's two point finite difference method (standard Box method). In regions where the streamwise velocity develops backflow, the solution method was modified (modified Box method) by two different procedures which allow the calculation of such flows. Local skin friction coefficients and displacement thickness values were computed for values of up to 1.25.
Author (ESA)

N79-31537# European Space Agency, Paris (France). Inst. fuer Stroemungslehre und Stroemungsmechanik.
TURBULENCE MEASUREMENTS IN A THREE DIMENSIONAL TURBULENT BOUNDARY LAYER
R. Dechow (Klein, Schanzlin u. Backer AG) and K. O. Felsch *In* ESA Contrib. on Transport Phenomena in Fluid Mech. and Related Topics (ESA-TT-498) Mar. 1979 p 42-51 refs Transl. into ENGLISH from "Beitraege zu Transportphaenomenen in der Stroemungsmechanik und anverwandten Gebieten", DFVLR, Berlin Report DLR-FB-77-16, Mar. 1977 p 29-36 Original report in German previously announced as N79-12370 (For primary document see N79-31534 22-34)
Avail: NTIS HC A14/MF A01

Measurements in a three-dimensional incompressible turbulent boundary layer growing in front of a cylinder standing on a flat wall in a wind tunnel were made beginning with the quasi two-dimensional boundary layer far in front of the cylinder. The development of the boundary layer profiles were investigated along a streamline of the free stream up to the region behind the three-dimensional separation. At 14 different stations, profiles were measured of the mean velocity vector, the 6 components of the turbulent stress tensor, the static pressure, and the wall shear stress vector. Measurements of the mean velocity and the static pressure in the region outside the boundary layer were also made. From this data the direction of the velocity gradient and of the turbulent shear stress were evaluated. The applicability of different shear stress models is checked and discussed.
Author (ESA)

N79-31538# European Space Agency, Paris (France). Abt. Mechanische Verfahrenstechnik.
ON THE MOTION OF SOLID PARTICLES IN CHEMICAL ENGINEERING
Fritz Ebert *In* ESA Contrib. on Transport Phenomena in Fluid Mech. and Related Topics (ESA-TT-498) Mar. 1979 p 52-63 refs Transl. into ENGLISH from "Beitraege zu Transportphaenomenen in der Stroemungsmechanik und anverwandten Gebieten", DFVLR, Berlin Report DLR-FB-77-16, Mar. 1977 p 37-42 Original report in GERMAN previously announced as N79-12371 (For primary document see N79-31534 22-34)
Avail: NTIS HC A14/MF A01

In connection with problems of chemical engineering, the motion of solid particles suspended in a fluid was studied. The example of hydraulic transport was treated by means of a simple model of particle response to fluid turbulence. The theory of Markov processes was used to describe the motion of dispersed solids in flow systems. As an example, air classifying of solids is discussed.
Author (ESA)

N79-31539# European Space Agency, Paris (France). Inst. fuer Luftstrahlantriebe.
INVESTIGATIONS ON TURBULENCE ENERGY EQUATIONS FOR TURBULENT JETS AND JET FLAMES
Heinrich Eickhoff and Frank Thiele (Tech. Univ., Berlin) *In* ESA Contrib. on Transport Phenomena in Fluid Mech. and Related Topics (ESA-TT-498) Mar. 1979 p 64-70 refs Transl. into ENGLISH from "Beitraege zu Transportphaenomenen in der Stroemungsmechanik und anverwandten Gebieten", DFVLR, Berlin Report DLR-FB-77-16, Mar. 1977 p 43-47 Original report in GERMAN previously announced as N79-12372 (For primary document see N79-31534 22-34)
Avail: NTIS HC A14/MF A01

The behavior of the turbulent energy in round free jets and free jet diffusion flames was studied using the Rotta inductive method for the calculation of the turbulent energy distribution from the distribution of the time averaged flow velocity. The energy distribution was compared with measurements of the axial components of the turbulence energy using the double jet laser method. The influence of the density distriubtion is shown experimentally and numerically.
Author (ESA)

N79-31540# European Space Agency, Paris (France). Herman-Foettinger Inst. fuer Thermo- und Fluiddynamik.
THREE DIMENSIONAL FLOW IN THE SAMPLING CHAMBER OF A GAS CENTRIFUGE IN THE PRESENCE OF A STATIONARY BODY. A DIFFERENCE PROCEDURE FOR SOLVING THE COMPRESSIBLE NAVIER-STOKES EQUATIONS
Eberhard Elsholz *In its* Contrib. on Transport Phenomena in Fluid Mech. and Related Topics, (ESA-TT-498) Mar. 1979 p 71-85 refs Transl. into ENGLISH from "Beitraege zu Transportphaenomen in der Stroemungsmechanik und anverwandten Gebieten", DFVLR, Berlin Report DLR-FB-77-16, Mar. 1977 p 49-57 Original GERMAN report previously announced as N79-12373 (For primary document see N79-31534 22-34)
Avail: NTIS HC A14/MF A01

The flow field in a very rapidly rotating chamber in the presence of a stationary body was calculated numerically from the complete set of Navier-Stokes equations. A special differential approximation provided stable and nonoscillating solutions even within the region of very small Ekman-numbers. This type of approximation was derived and its advantages are discussed. A numerical result is presented which includes strong radial density gradients and shows very clearly the compressible effects as well as the mechanism of vortex shedding generated by the obstacle.
Author (ESA)

N79-31541# European Space Agency, Paris (France).
SEPARATION POWER DENSITY OF GAS DYNAMICAL ISOTOPE SEPARATION PROCEDURES FOR THE ENRICHMENT OF U-235 IN THE PRESENCE OF LIGHT ADDITIVE GASES
Wilmar Fuhse *In* ESA Contrib. on Transport Phenomena in Fluid Mech. and Related Topics (ESA-TT-498) Mar. 1979 p 86-92 refs Transl. into ENGLISH from "Beitraege zu Transportphaenomenen in der Stroemungsmechanik und anverwandten Gebieten", DFVLR, Berlin Report DLR-FB-77-16, Mar. 1977 p 59-63 Original report in GERMAN previously announced as N79-12374 (For primary document see N79-31534 22-34)
Avail: NTIS HC A14/MF A01

The separation power density of gas dynamical enrichment

processes was evaluated. The method allows a transparent inclusion of auxilliary gases in the theory of isotope separation. The final formula of the separation power density shows strong similarities to the equations used for binary gas mixtures. The results obtained on two component mixtures can be applied to gas dynamical enrichment processes with more than two components. Author (ESA)

N79-31542# European Space Agency, Paris (France). Fachbereich Maschinentechnik.

DRAG OF A CIRCULAR CYLINDER UNDER TRANSVERSE RAREFIED GAS FLOW

Bernhard Gampert *In* ESA Contrib. on Transport Phenomena in Fluid Mech. and Related Topics (ESA-TT-498) Mar. 1979 p 93-103 refs Transl. into ENGLISH from "Beitraege zu Transportphaenomenen in der Stroemungsmechanik und anverwandten Gebieten", DFVLR, Berlin Report DLR-FB-77-16, Mar. 1977 p 65-70 Original report in GERMAN previously announced as N79-12375 (For primary document see N79-31534 22-34)
Avail: NTIS HC A14/MF A01

A formula is presented giving the drag coefficient for low Re-number slip flow normal to the axial of an infinite circular cylinder. The equation is not confined to tangential accommodation coefficients of the order of unity. In contrast to the nonslip case a viscous normal stress acts across the cylinder surface. Under perfect slip the two normal stresses in common are even larger than under nonslip. For zeta = 1.0 the friction drag is already reduced to 15% of its nonslip value. Author (ESA)

N79-31543# European Space Agency, Paris (France).

ENERGY CONSUMPTION FOR AERODYNAMIC SPINNING

L. Gerking *In* ESA Contrib. on Transport Phenomena in Fluid Mech. and Related Topics (ESA-TT-498) Mar. 1979 p 104-110 ref Transl. into ENGLISH of "Beitraege zu Transportphaenomenen in der Stroemungsmechanik und anverwandten Gebieten", DFVLR, Berlin Report DLR-FB-77-16, Mar. 1977 p 71-76 Original report in GERMAN previously announced as N79-12376 (For primary document see N79-31534 22-34)
Avail: NTIS HC A14/MF A01

The energy consumption associated with the spinning of filaments by aerodynamic drawing, a technique used in the manufacture of nonwovens direct from the melt, is discussed. It is argued that values of 0.5 kWhr/kg are normally attainable. Author (ESA)

N79-31544# European Space Agency, Paris (France). Fachbereich Stroemungstechnik.

THEORETICAL PREDICTION OF THE INCLINATION ANGLE OF THE SEPARATION STREAMLINE IN SEPARATION BUBBLES

Dieter Geropp *In* ESA Contrib. on Transport Phenomena in Fluid Mech. and Related Topics (ESA-TT-498) Mar. 1979 p 111-121 refs Transl. into ENGLISH of "Beitraege zu Transportphaenomenen in der Stroemungsmechanik und anverwandten Gebieten", DFVLR, Berlin Report DLR-FB-77-16, Mar. 1977 p 77-84 Original report in GERMAN previously announced as N79-12377 (For primary document see N79-31534 22-34)
Avail: NTIS HC A14/MF A01

The angle of the separation was calculated by a boundary layer integral method of the Pohlhausen type. A simple formula for the dependence on the local Reynolds number and on a pressure parameter in the separation point of a bubble is presented. The theorem is confirmed by experiments. Some contradictions in published statements concerning the pressure dependence are cleared up. Author (ESA)

N79-31545# European Space Agency, Paris (France). Inst. fuer Thermo- und Fluiddynamik.

BOUNDARY LAYER EFFECTS OF HIGHER ORDER FOR COMBINED FREE AND FORCED CONVECTION

Klaus Gernsten (Univ. Federal de Sergipe, Aracaju, Brazil) and Joao S. d'Avila *In* ESA Contrib. on Transport Phenomena in Fluid Mech. and Related Topics (ESA-TT-498) Mar. 1979 p 122-131 refs Transl. into ENGLISH of "Beitraege zu Transportphaenomen in der Stroemungsmechanik und anverwandten Gebieten", DFVLR, Berlin Report DFL-FB-77-16, Mar. 1978 p 85-90 Original report in GERMAN previously announced as N79-12378 (For primary document see N79-31534 22-34)
Avail: NTIS HC A14/MF A01

For flows essentially influenced by buoyancy forces the first and second-order boundary layer equations are derived. The importance of second-order boundary layer effects on combined free and forced convection is shown and discussed in detail for the flow along a horizontal heated flat plate. Author (ESA)

N79-31546# European Space Agency, Paris (France). Inst. fuer Stroemungslehre und Stroemungsmachinen.

THE WALZ WIND VANE MODEL AND ITS APPLICATION TO THE SIMULATION OF FLOWS WITH DEAD-AIR REGIONS

Joachim Grashof *In* ESA Contrib. on Transport Phenomena in Fluid Mech. and Related Topics (ESA-TT-498) Mar. 1979 p 132-145 refs Transl. into ENGLISH of "Beitraege zu Transportphaenomen in der Stroemungsmechanik und anverwandten Gebieten", DFVLR, Berlin Report DLR-FB-77-16, Mar. 1978 p 91-98 Original report in GERMAN previously announced as N79-12379 (For primary document see N79-31534 22-34)
Avail: NTIS HC A14/MF A01

The Walz model developed in 1939 to simulate the dead air region past airfoils with trailing-edge flaps is summarized and its physical background and mathematical treatment are generalized. The fundamentals of the improved method for the calculation of pressure distributions on airfoils with dead air regions are outlined. Author (ESA)

N79-31547# European Space Agency, Paris (France). Inst. fuer Angewandte Gasdynamik.

A PROCEDURE FOR THE CALCULATION OF GAP-CORNER FLOWS

Roger Grundmann *In* ESA Contrib. on Transport Phenomena in Fluid Mech. and Related Topics (ESA-TT-498) Mar. 1979 p 146-156 refs Transl. into ENGLISH of "Beitraege zu Transportphaenomenen in der Stroemungsmechanik und anverwandten Gebieten", DFVLR, Berlin Report DLR-FB-77-16, Mar. 1978 p 99-106 Original report in GERMAN previously announced as N79-12380 (For primary document see N79-31534 22-34)
Avail: NTIS HC A14/MF A01

The flow behavior in the area of the floor of high speed ground transportation vehicles was calculated. A simplified gap-corner configuration formed by a U-formed finite sledge, which runs over an upright standing rail was introduced for this calculation. The reduced system of differential equations, which describes the three dimensional, laminar, compressible flow, led to an initial boundary value problem. An implicit finite difference scheme of alternating directions was developed to solve the system of equations. Because of the high gradients of the flow quantities in the corner areas the method of alternating directions was iterated additionally in each computational plane. The method of solution can be applied for high as well as for low Reynolds numbers. Author (ESA)

N79-31548# European Space Agency, Paris (France). Hermann-Foettinger Inst. fuer Thermo- und Fluiddynamik.

SOLVING THE TWO DIMENSIONAL NAVIER-STOKES EQUATIONS FOR FLOWS AROUND RANDOM BODY CONFIGURATIONS

Werner Haase and Joachim Hindenberg *In* ESA Contrib. on Transport Phenomena in Fluid Mech. and Related Topics (ESA-TT-498) Mar. 1979 p 157-173 refs Transl. into ENGLISH of "Beitraege zu Transportphaenomenen in der Stroemungsmechanik und anverwandten Gebieten", DFVLR, Berlin Report DLR-FB-77-16, Mar. 1978 p 107-118 Original report in GERMAN previously announced as N79-12381 (For primary document see N79-31534 22-34)
Avail: NTIS HC A14/MF A01

The two dimensional, incompressible Navier-Stokes equations were approximated by finite difference methods using a Cartesian (x,y) grid of points. Even the use of nonbody fitted coordinate systems allows the representation of arbitrarily shaped bodies. A discrete set of grid points was previously defined to be located on the surface where in the case of nonslip flow a zero velocity was indicated. The problems of flow about a circular cylinder were compared with experimental and numerical investigations of several authors. Author (ESA)

N79-31549# European Space Agency, Paris (France). Aerodyn. Inst.

PURE COUNTERCURRENTS IN ROTATING GASES

Dieter Haenel and Gerhard Langbein (Urenco Ltd.) *In* ESA Contrib. on Transport Phenomena in Fluid Mech. and Related Topics (ESA-TT-498) Mar. 1979 p 174-179 refs Transl. into ENGLISH of "Beitraege zu Transportphaenomenen in der Stroemungsmechanik und anverwandten Gebieten", DFVLR, Berlin Report DLR-FB-77-16, Mar. 1977 p 119-123 Original report in GERMAN previously announced as N79-12382 (For primary document see N79-31534 22-34)

Avail: NTIS HC A14/MF A01

The possibility of producing pure countercurrents, defined as currents in which the flows within two velocity inversion surfaces are constant so that there is no flow component across the velocity inversion surfaces, is discussed. A method for analyzing pure countercurrents is presented. It is shown that pure axial flow with constant velocity cannot exist for a compressible fluid. J.M.S.

N79-31550# European Space Agency, Paris (France). Inst. fuer Angewandte Gasdynamik.

A PROCEDURE FOR THE CALCULATION OF BOUNDARY LAYERS IN FLOW SYMMETRY PLANES

Ernst Heinrich Hirschel and Dieter Schwamborn *In* ESA Contrib. on Transport Phenomena in Fluid Mech. and Related Topics (ESA-TT-498) Mar. 1979 p 180-196 refs Transl. into ENGLISH of "Beitraege zu Transportphaenomenen in der Stroemungsmechanik und anverwandten Gebieten", DFVLR, Berlin Report DLR-FB-77-16, Mar. 1977 p 125-132 Original report in GERMAN previously announced as N79-12383 (For primary document see N79-31534 22-34)

Avail: NTIS HC A14/MF A01

The foundations are given for an exact method for the calculation of quasi two dimensional boundary layers in symmetrical planes of flows about bodies. The boundary layer can be incompressible or compressible, laminar or turbulent (mixing-length model of R. Michel). The two dimensional and the axisymmetric case are included. Longitudinal and transverse curvature of the contour can be taken into account; at the wall blowing or suction may occur, and temperature or temperature gradient (heat transfer) can be observed. The governing equations are solved by means of a finite difference method. A sample calculation is discussed. Author (ESA)

N79-31551# European Space Agency, Paris (France). Fachbereich Maschinentechnik.

ON IMPROVEMENTS OF THE DISSIPATION INTEGRAL METHOD FOR THE CALCULATION OF TURBULENT BOUNDARY LAYERS

Michael Jischa and Klaus Homann *In* ESA Contrib. on Transport Phenomena in Fluid Mech. and Related Topics (ESA-TT-498) Mar. 1979 p 197-207 refs Transl. into ENGLISH of "Beitraege zu Transportphaenomenen in der Stroemungsmechanik und anverwandten Gebieten", DFVLR, Berlin Report DLR-FB-77-16, Mar. 1977 p 133-138 Original report in GERMAN previously announced as N79-12384 (For primary document see N79-31534 22-34)

Avail: NTIS HC A14/MF A01

The prediction of incompressible two dimensional turbulent boundary layers is discussed. An integral method based on the momentum and the mean kinetic energy equations was developed. A third integral equation was added to calculate the dissipation integral. This equation was derived from the turbulent energy equation and takes into account the flow. Author (ESA)

N79-31552# European Space Agency, Paris (France).

THE COMPUTATION OF SEPARATED DIFFUSER FLOWS

Stephen J. Kline and Sanjoy Ghose (IBM, San Jose, Calif.) *In* ESA Contrib. on Transport Phenomena in Fluid Mech. and Related Topics (ESA-TT-498) Mar. 1979 p 208-223 refs Transl. into ENGLISH of "Beitraege zu Transportphaenomenen in der Stroemungsmechanik und anverwandten Gebieten", DFVLR, Berlin Report DLR-FB-77-16, Mar. 1977 p 139-149 Original report in GERMAN previously announced as N79-12385 (For primary document see N79-31534 22-34)

Avail: NTIS HC A14/MF A01

A summary of recent research into internal flows with separation is presented. Cases include incompressible, straight-walled channels with both laminar and turbulent boundary layers for plenum exit conditions. Fully developed separations were studied for both two dimensional and axisymmetric flows. Successful computer programs for predicting such flows were constructed. A more advanced program was created that successfully predicts first-order flow quantities in channels with incipient and small amounts of separation. Emphasis is placed on why many earlier attempts to model separated flows have failed and how the difficulties can be corrected by appropriate modeling of the interaction between the pressure field of the outer flow and the blockage effects of boundary layers and separated zones. Author (ESA)

N79-31553# European Space Agency, Paris (France). Unternehmensbereich Apparate.

ON AN AEROBALLISTIC OPTIMIZATION PROBLEM

H.-G. Knoche *In* ESA Contrib. on Transport Phenomena in Fluid Mech. and Related Topics (ESA-TT-498) Mar. 1979 p 224-233 refs Transl. into ENGLISH of "Beitraege zu Transportphaenomenen in der Storemungsmechanik und anverwandten Gebieten", DFVLR Berlin Report DLR-FB-77-16, Mar. 1977 p 151-156 Original report in GERMAN previously announced as N79-12386 (For primary document see N79-31534 22-34)

Avail: NTIS HC A14/MF A01

The accuracy of ballistic missiles determined essentially by the aeroballistic properties of the missile itself is discussed. The inherent dispersion characteristics of the ballistic missile at the end of the boost-phase due to the influence of thrust misalignment, launcher deflection, and cross-wind effects can be minimized by a suitable design of the missile's aerodynamic stability with the help of a time-dependent change of the stability. The effects of the exhaust plume and the longitudinal acceleration on aerodynamic stability are considered. Author (ESA)

N79-31554# European Space Agency, Paris (France). Bereich Feuerungstechnik.

VELOCITY AND CONCENTRATION PROFILES IN THE STABILIZATION REGION OF FREE JET FLAMES

B. Lenze and R. Guenther *In* ESA Contrib. on Transport Phenomena in Fluid Mech. and Related Topics (ESA-TT-498) Mar. 1979 p 234-243 refs Transl. into ENGLISH of "Beitraege zu Transportphaenomenen in der Stroemungsmechanik und anverwandten Gebieten", DFVLR, Berlin Report DLR-FB-77-16, Mar. 1978 p 157-162 Original report in GERMAN previously announced as N79-12387 Sponsored by Deut. Forschungsgemeinschaft. (For primary document see N79-31534 22-34)

Avail: NTIS HC A14/MF A01

For the calculation of injectors and of stabilization zones of turbulent diffusion and premixed flames the transition region and the mixing region with the potential core were taken into account. The measurements and simple calculations presented the possibility of calculating the velocity and concentration profiles in the mixing and transition region of cold free jets by a Gaussian distribution. With these results stabilization zones at the base of a turbulent flame, can be determined provided the turbulent flame velocity is known. The mean value, not the local values, of the latter can be calculated beforehand. The method was applied to the calculation of the stabilization zones of an ethane flame. Author (ESA)

N79-31555# European Space Agency, Paris (France).

THE VORTEX CONCEPT IN THE HISTORY OF SCIENCE

Hans J. Lugt *In* ESA Contrib. on Transport Phenomena in Fluid Mech. and Related Topics (ESA-TT-498) Mar. 1979 p 244-259 refs Transl. into ENGLISH of "Beitraege zu Transportphaenomenen in der Stroesmungsmechanik und anverwandten Gebieten", DFVLR, Berlin Report DLR-FB-77-16, Mar. 1977 p 163-170 Original report in GERMAN previously announced as N79-12388 (For primary document see N79-31534 22-34)

HC A14/MF A01

Topics include the mythological era, art and vortices, the age of classical mechanics, and the impact on modern sciences. Since prehistoric times the vortex concept has been used an an explanatory principle to describe and interpret fundamental natural phenomena. In the study of the macrocosmos, the analysis of

vortices was applied to solve cosmological problems, in particular to explain the evolution of the universe and the motions of celestial bodies. In studying the microcosmos, vortical behavior served as a mechanical model to support the idea of the atomic structure of matter. Both of these gigantic efforts throughout the greater part of human history fell short and ended at the beginning of this century with the rise of modern physics. The development and application of a vortex theory within the realm of classical mechanics have led the vortex concept to its biggest triumph and to a great technological success. Author (ESA)

N79-31556# European Space Agency, Paris (France). Inst. fuer Reaktorbauelemente.

FREE CONVECTION IN A WEDGE SHAPED GAP

U. Mueller *In* ESA Contrib. on Transport Phenomena in Fluid Mech. and Related Topics (ESA-TT-498) Mar. 1979 p 260-267 refs Transl. into ENGLISH of "Beitraege zu Transportphaenomenenin der Stroemungsmechanik und anverwandten Gebieten", DFVLR, Berlin Report DLR-FB-77-16, Mar. 1977 p 171-175 Original report in GERMAN previously announced as N79-12389 (For primary document see N79-31534 22-34)

Avail: NTIS HC A14/MF A01

A selfsimilar solution for the velocity and temperature field in the free convection flow in a wedge shaped gap is presented. It was assumed that the Boussinesq approximation is valid, that the medium was incompressible, and that dissipation could be neglected. The investigations were conducted for the geometrically simple case of a horizontal wall with constant temperature and an inclined wall with radially variable temperature. The inclination of the wall was limited to small angles. Author (ESA)

N79-31557# European Space Agency, Paris (France).

A TRANSFORMATION CONCEPT FOR THE CALCULATION OF TURBULENT COMPRESSIBLE BOUNDARY LAYERS

Wolfgang Neubert *In* ESA Contrib. on Transport Phenomena in Fluid Mech. and Related Topics (ESA-TT-498) Mar. 1979 p 268-277 refs Transl. in ENGLISH of "Beitraege zu Transportphaenomenen in der Stroemungsmechanik und anverwandten Gebieten", DFVLR, Berlin Report DLR-FB-77-16, Mar. 1977 p 177-183 Original report in GERMAN previously announced as N79-12390 (For primary document see N79-31534 22-34)

Avail: NTIS HC A14/MF A01

Based on the friction coefficient c sub f transformation of Van Driest and successfully used expressions for the incompressible turbulent velocity profile, a method is introduced to formulate a turbulent compressible velocity profile. In connection with the compressible integral relations of the boundary layer theory, a possibility to calculate the turbulent compressible boundary-layer directly is presented. Author (ESA)

N79-31558# European Space Agency, Paris (France).

INTERFEROMETRIC INVESTIGATIONS ON SUPERSONIC JET NOISE

Herbert Oertel *In* ESA Contrib. on Transport Phenomena in Fluid Mech. and Related Topics (ESA-TT-498) Mar. 1979 p 278-289 refs Transl. into ENGLISH of "Beitraege zu Transportphaenomenen in der Stroemungsmechanik und anverwandten Gebieten", DFVLR, Berlin Report DLR-FB-77-16, Mar. 1977 p 185-190 Original report in GERMAN previously announced as N79-12391 (For primary document see N79-31534 22-34)

Avail: NTIS HC A14/MF A01

Interference pictures and streak records taken with complementary double exposure were used for investigating the influence of supersonic jet characteristics on the speeds of those mixing layer structures which are accompanied by particularly long and straight Mach waves. Jets with data varied within large ranges were produced by means of a shock tube. Three preferred structure velocities were detected, the ratios of which to the ambient sound velocity are solely dependent on a given Mach number and sound speed ratio. The results are represented by simple formula. Author (ESA)

N79-31559# European Space Agency, Paris (France). Hermann-Foettinger-Inst. fuer Thermo- und Fluiddynamik.

NUMERICAL SOLUTION OF THREE DIMENSIONAL FLOW PROBLEMS BY MEANS OF FAST FOURIER TRANSFORMATION

Franz Otte (Ges. fuer Controling u. Wirtschaftberatung mbH) and Frank Thiele *In* ESA Contrib. on Transport Phenomena in Fluid Mech. and Related Topics (ESA-TT-498) Mar. 1979 p 290-300 refs Transl. into ENGLISH from "Beitraege zu Transportphaenomenen in der Stroemungsmechanik und anverwandten Gebieten", DFVLR, Berlin Report DLR-FB-77-16, Mar. 1977 p 191-198 Original report in GERMAN previously announced as N79-12392 (For primary document see N79-31534 22-34)

Avail: NTIS HC A14/MF A01

An efficient method for the time independent numerical calculation of incompressible three dimensional flow was developed. As a direct linear solution the Fast Fourier Transforms were used at each iteration for the nonlinear partial differential equations. The Navier-Stokes equations were formulated as equations for vorticity and velocity. The flow in a driven cavity with combined free and forced convection was calculated as an example. Author (ESA)

N79-31560# European Space Agency, Paris (France). Inst. fuer Allgemeine Mechanik.

THERMAL IGNITION IN BOUNDARY LAYERS

Norbert Peters *In* ESA Contrib. on Transport Phenomena in Fluid Mech. and Related Topics (ESA-TT-498) Mar. 1979 p 301-312 refs Transl. into ENGLISH from "Beitraege zu Transportphaenomenen in der Stroemungsmechanik und anverwandten Gebieten", DFVLR, Berlin Report DLR-FB-77-16, Mar. 1977 p 199-207 Original report in GERMAN previously announced as N79-12393 (For primary document see N79-31534 22-34)

Avail: NTIS HC A14/MF A01

A simplified theory of homogeneous ignition based on the local description of the boundary layer equations is presented. An algebraic relation between the surface temperature theta sub w and the homogeneous number Da derived which is identical to the formula derived by Waldman for the case of heterogeneous ignition. The stable and unstable parts of the S-shaped curve theta sub w = theta sub 2 (Da) were determined by a linear stability analysis. An equation for the ignition temperature was derived and expanded for large values of the mondimensional activation energy. It is shown that the Seminov formula for the temperature rise is not restricted to zero order reactions but is the high activation energy limit for all values of the reaction order. The homogeneous Damkoehler number is related to Adomeit's ignition parameter psi which was obtained the evaluation of experimental data. Author (ESA)

N79-31561# European Space Agency, Paris (France).

AN ANALYTIC SOLUTION FOR THE ENRICHMENT OF URANIUM HEXAFLUORIDE IN LONG COUNTERCURRENT CENTRIFUGES

E. Baetz *In* ESA Contrib. on Transport Phenomena in Fluid Mech. and Related Topics (ESA-TT-498) Mar. 1979 p 313-324 refs Transl. into ENGLISH from "Beitraege zu Transportphaenomenen in der Stroemungsmechanik und anverwandten Gebieten", DFVLR, Berlin Report DLR-FB-77-16, Mar. 1978 p 209-214 Original report in GERMAN previously announced as N79-12394 (For primary document see N79-31534 22-34)

Avail: NTIS HC A14/MF A01

An analytical solution for the enrichment and the separative power of long countercurrent centrifuges based on the Cohen equation and assuming an isothermal, mainly axial, flow except near the end caps is described. Equations for obtaining optimal operation parameters such as feed and feed input height were derived and solved. Author (ESA)

N79-31562# European Space Agency, Paris (France). Fachgebiet Bionik und Evolutionstechnik.

DRAG REDUCTION BY SURFACE TREATMENT WITH MACROMOLECULAR COMPOUNDS OF BODIES IMMERSED IN A FLUID FLOW

I. Rechenberg and P. Bienert *In* ESA Contrib. on Transport Phenomena in Fluid Mech. and Related Topics (ESA-TT-498) Mar. 1979 p 325-339 refs Transl. into ENGLISH from "Beitraege zu Transportphaenomen in der Stroemungsmechanik und anverwandten Gebieten", DFVLR, Berlin Report DLR-FB-77-16, Mar. 1977 p 215-224 Original report in GERMAN previously announced as N79-12395 (For primary document see N79-31534 22-34)

Avail: NTIS HC A14/MF A01

The influence of surface treatment on fluid flow drag, using the Toms effects as a starting point, was studied. By adding not more than a few parts per million of long-chain molecules or microscopic small fibers to water, drag in turbulent flow may be reduced up to 70 percent. There is a limit to this technology if water flowing around the body-surface is renewed continuously. The adhesion technique is proposed as an alternative method to the well-known additive technique: the turbulence reducing agent is adhering on the surface of the body. A biological model of this new technique: the mucous tissue of fish is discussed.

Author (ESA)

N79-31563# European Space Agency, Paris (France).

INTEGRAL METHOD FOR CALCULATION OF THREE-DIMENSIONAL TURBULENT INCOMPRESSIBLE BOUNDARY LAYERS

H. W. Stock *In* ESA Contrib. on Transport Phenomena in Fluid Mech. and Related Topics (ESA-TT-498) Mar. 1979 p 340-359 refs Transl. into ENGLISH from "Beitraege zu Transportphaenomenen in der Stroemungsmechanik und anverwandten Gebieten", DFVLR, Berlin Report DLR-FB-77-16, Mar. 1977 p 225-236 Original report in GERMAN previously announced as N79-12396 (For primary document see N79-31534 22-34)

Avail: NTIS HC A14/MF A01

An integral method using the momentum and entrainment and equations in curvilinear, nonorthogonal coordinates is presented. The three dimensional velocity profile was composed of profiles in the streamwise and crosswise direction. The two parameter profile family of Coles was applied for the streamwise direction which represents the velocity distribution in boundary layers in accelerated and decelarated flows very well. For the cross flow profiles the Mager and Johnston formulation was used. In the method presented the lag entrainment idea was applied to overcome Head's correlation between the entrainment coefficient and a shape parameter, which is only valid for equilibrium boundary layers. Comparison with the experiments of Van den Berg and Elsenaar, Johnston and Vermeulen is shown.

Author (ESA)

N79-31564# European Space Agency, Paris (France). Fachbereich Luft- und Raumfahrttechnik.

ON THE THERMODYNAMIK ENERGY LAW

D. Straub, R. Waibel, and V. Lippig *In* ESA Contrib. on Transport Phenomena in Fluid Mech. and Related Topics (ESA-TT-498) Mar. 1979 p 360-372 refs Transl. into ENGLISH from "Beitraege zu Transportphaenomenen in der Stroemungsmechanik und anverwandten Gebieten", DFVLR, Berlin Report DLR-FB-77-16, Mar. 1978 p 237-243 Original report in GERMAN previously announced as N79-12397 (For primary document see N79-31534 22-34)

Avail: NTIS HC A14/MF A01

Engineering thermodynamics deals with the concept of a system involving the energy transfer quantities heat and work. The distinction between heat and work may be expressed in their divergent relations to entropy. For open systems in particular, the concept of device may be applied to definite identification of work. This concept is of analogous significance as the concept is of consequences result in four statements about the energy theorem, by means of which, e.g., the derivation of the balance equations of continuum mechanics may be put on a new basis.

Author (ESA)

N79-31565# European Space Agency, Paris (France).

INVERSE INTEGRAL METHOD FOR CALCULATION OF SEPARATED BOUNDARY LAYERS

P. Thiede *In* ESA Contrib. on Transport Phenomena in Fluid Mech. and Related Topics (ESA-TT-498) Mar. 1979 p 373-388 refs Transl. into ENGLISH from "Beitraege zu Transportphaenomenen in der Stroemungsmechanik und anverwandten Gebieten", DFVLR, Berlin Report DLR-FB-77-16, Mar. 1977 p 245-255 Original report in GERMAN previously announced as N79-12398 (For primary document see N79-31534 22-34)

HC A14/MF A01

For the prediction of separated compressible turbulent two dimensional boundary layers an inverse integral method was developed in which the surface pressure is defined as dependent variable with either a prescribed displacement thickness or a prescribed streamline angle at the boundary layer edge. For the relations of the reverse flow velocity profiles similar solutions of Alber are used as a basis, and the history effects are considered by an empirical relation. The efficiency of the prediction method is appraised with tests in separated transonic flow. Author (ESA)

N79-31566# European Space Agency, Paris (France). Hermann-Foettinger Inst. fuer Thermo- und Fluiddynamik.

ANALYTICAL INVESTIGATIONS ON THE UNMIXEDNESS IN TURBULENT DIFFUSION FLAMES

Frank Thiele *In* ESA Contrib. on Transport Phenomena in Fluid Mech. and Related Topics (ESA-TT-498) Mar. 1979 p 389-400 refs Transl. into ENGLISH from "Beitraege zu Transportphaenomenen in der Stroemungsmechanik und anverwandten Gebieten", DFVLR, Berlin Report DLR-FB-77-16, Mar. 1977 p 257-264 Original report in GERMAN previously announced as N79-12399 (For primary document see N79-31534 22-34)

Avail: NTIS HC A14/MF A01

The phenomenon of unmixedness in turbulent diffusion flames is described by a simple model based on concentration fluctuations of the chemical species. Using the proposed model the combustion of an axisymmetric hydrogen jet in quiet air was calculated numerically under the assumption of local chemical equilibrium. The results are compared with experimental data. An essential influence of the unmixedness of the flow field is shown.

Author (ESA)

N79-31567# European Space Agency, Paris (France). Lehrstuhl fuer Stroemungsmechanik.

INTEGRAL REPRESENTATION OF ENERGY EQUATIONS IN FLUID MECHANICS

E. Truckenbrodt *In* ESA Contrib. on Transport Phenomena in Fluid Mech. and Related Topics (ESA-TT-498) Mar. 1979 p 401-409 refs Transl. into ENGLISH from "Beitraege zu Transportphaenomenen in der Stroemungsmechnik und anverwandten Gebieten", DFVLR, Berlin Report DLR-FB-77-16, Mar. 1977 p 265-270 Original report in GERMAN previously announced as N79-12400 (For primary document see N79-31534 22-34)

Avail: NTIS HC A14/MF A01

A critical comparison is presented between the energy equation in fluid mechanics (kinetic energy equation) and the energy equation in thermofluid mechanics (first law of thermodynamics) in their integral forms.

Author (ESA)

N79-31568# European Space Agency, Paris (France). Hermann-Foettinger Inst. fuer Thermo- und Fluiddynamik.

COMMENTS ON MANUFACTURING AND APPLICATION OF HOT-WIRE PROBES IN THE FLOW LABORATORY

J. D. Vagt and A. Dahm *In* ESA Contrib. on Transport Phenomena in Fluid Mech. and Related Topics (ESA-TT-498) Mar. 1979 p 410-418 refs Transl. into ENGLISH from "Beitraege zu Transportphaenomenen in der Stroemungsmechanik und anverwandten Gebieten", DFVLR, Berlin Report DLR-FB-77-16, Mar. 1978 p 271-276 Original report in GERMAN previously announced as N79-12401 (For primary document see N79-31534 22-34)

Avail: NTIS HC A14/MF A01

Improvements to hot-wire probes used very frequently in experimental fluid mechanics, are presented. In the field of turbulence research in particular, there are hardly any other instruments which can be so widely used. Although the hot-wire technique has been developed over a long period, problems still arise due, for example, to the design and shape of the probe with respect to the flow. Some of these problems, which stem from the flow around the probe holder, wire arrangement, and vibrations are discussed, they can be solved by special design of the probes.

Author (ESA)

N79-31569# European Space Agency, Paris (France). Abt. fuer Theoretische Aerodynamik.

THEORETICAL INVESTIGATIONS ON THE SHOCK WAVE BOUNDARY LAYER INTERACTION KRYOGENEM STICKSTOFF

Bernhard Wagner and Wolfgang Schmidt *In* ESA Contrib. on Transport Phenomena in Fluid Mech. and Related Topics (ESA-TT-498) Mar. 1979 p 419-436 refs Transl. into ENGLISH

from "Beitraege zu Transportphaenomenen in der Stroemungsmechanik und anverwandten Gebieten", DFVLR, Berlin Report DLR-FB-77-16, Mar. 1977 p 277-287 Original report in GERMAN previously announced as N79-12402 (For primary document see N79-31534 22-34)
Avail: NTIS HC A14/MF A01

The basic effects of low temperatures close to liquefaction in cryogenic wind tunnels were studied theoretically for viscous compressible flow on the basis of shock wave-laminar boundary layer interaction. The full Navier-Stokes equations in combination with the equations of state for a real gas and the material properties for low temperatures were solved by means of a finite volume method and MacCormack's time splitting technique. Results show relatively small deviations compared with the ideal gas case. The differences in the pressure distribution are caused mainly by real gas effects in the inviscid external flow field while the changes in the skin friction coefficients depend mainly on the different viscosity characteristics and on the real gas effects in the temperature distribution. Author (ESA)

N79-31570# European Space Agency, Paris (France). Inst. fuer Kerntechnik.
INVESTIGATIONS OF CAVITATION PHENOMENA IN PUMPS AND IN PIPES WITH DIAPHRAGM INLET USING RESONANCE DETECTORS
U. Wesser and J. Klockgethter *In* ESA Contrib. on Transport Phenomena in Fluid Mech. and Related Topics (ESA-TT-498) Mar. 1979 p 437-447 refs Transl. into ENGLISH from "Beitraege zu Transportphaenomenen in der Stroemungsmechanik und anverwandten Gebieten", DFVLR, Berlin Report DLR-FB-77-16, Mar. 1977 p 289-296 Original report in GERMAN previously announced as N79-12403 Sponsored by Ges. fuer Kernergieverwertung in Schiffbau u. Schiffahrt (For primary document see N79-31534 22-34)
Avail: NTIS HC A14/MF A01

In fluid flows with high acoustic noise levels, resonance detectors were applied to measure cavitation phenomena in pumps. The analysis of the acoustic signals associated with the collapse of transient cavities leads to statistical parameters characterizing the cavitation state in the flow. The method is applicable even in the state of incipient cavitation. Some results for pumps and pipes are reported. Author (ESA)

N79-31571# European Space Agency, Paris (France). Inst. fuer Stroemungslehre und Stroemungsmaschinen.
ON THE SOLUTION OF UNSTEADY TRANSONIC EQUATIONS
Juergen Zierep *In* ESA Contrib. on Transport Phenomena in Fluid Mech. and Related Topics (ESA-TT-498) Mar. 1979 p 448-455 refs Transl. into ENGLISH from "Beitraege zu Transportphaenomenen in der Stroemungsmechanik und anverwandte Gebieten", DFVLR, Berlin Report DLR-FB-77-16, Mar. 1977 p 448-455 Original report in GERMAN previously announced as N79-12404 (For primary document see N79-31534 22-34)
Avail: NTIS HC A14/MF A01

The unsteady transonic equations are studied and the conditions under which the transonic flow equations leads to the steady state solution are discussed. Special attention is given to the limit M sub infinity as it approaches 1. Author (ESA)

N79-31572# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering and Applied Mechanics.
A NEW APPROACH FOR SOLVING THE VORTICITY AND CONTINUITY EQUATIONS IN TURBOMACHINERY DUCTS Interim Report
A. Hamed and S. Abdallah Jan. 1979 10 p refs Presented at the 17th Aerospace Sci. Meeting, New Orleans, 15-17 Jan. 1979
(Contract F49620-78-C-0041; AF Proj. 2307)
(AD-A069999; AFOSR-79-0630TR; Paper-79-0046) Avail: NTIS HC A02/MF A01 CSCL 20/4

Repeated solutions to the continuity and vorticity equations are frequently required in computations of three dimensional flows in turbomachinery passages. When the two equations are nonhomogeneous previous formulations resulted in two second order differential equations. A new approach is presented here, which is applicable in a generalized two dimensional domain or axisymmetric field. It is based on the definition of a streamlike function which is used to transform these nonhomogeneous first order partial differential equations to a single second order equation with Dirichlet boundary conditions over the solid boundaries. Some applications are presented to show how this new approach can be used to save computer time in numerical flow solutions. (GRA)

N79-31573# California Univ., Berkeley. Dept. of Mechanical Engineering.
APPLICATIONS OF RAYLEIGH SCATTERING TO TURBULENT FLOWS WITH HEAT TRANSFER AND COMBUSTION Interim Report, 1 Mar. 1978 - 1 Mar. 1979
Lawrence Talbot 1979 11 p refs
(Contract F44620-76-C-0083; AF Proj. 2307)
(AD-A069981; AFOSR-79-0652TR) Avail: NTIS HC A02/MF A01 CSCL 20/4

Further development of instrumentation and data processing techniques to improve Rayleigh scattering and laser doppler anemometry LDA as diagnostic techniques in turbulent flows with combustion has continued. A computerized disk operated data acquisition system with 8 channels of 12 bit A/D conversion, a CRT terminal with graphics, and a line printer for permanent copy output has been completed. The data acquisition system was used to study the effect of H2-air combustion on induced turbulence in a heated boundary layer. Mean, rms fluctuations, probability density functions and autocorrelation were obtained for density and velocity. Three modes of combustion were indicated: 1 surface reaction, 2 surface reaction combined with gas phase reaction, and 3 flame-like structure at the edge of the boundary layer. (GRA)

N79-31574# Northwestern Univ., Evanston, Ill. Dept. of Chemical Engineering.
CRUST BEHAVIOR IN SIMULTANEOUS MELTING AND FREEZING ON A SUBMERGED FLAT PLATE
A. Ganguli and S. G. Bankoff Dec. 1978 51 p ref
(Contract EN-77-S-02-4171)
(COO-4171-2) Avail: NTIS HC A04/MF A01

A theoretical and experimental investigation of the solidivation of a flowing liquid onto a melting wall was carried out. The experimental work involved open channel laminar flow of water over a flat plate of n-decane. The dynamic behavior of the solidified crust which forms a leading edge by melting was studied. The motion of this leading edge was determined as a function of the water temperature, velocity, decane temperature, and outlet weir height. This melting rate was found to be very sensitive to the water temperature and less dependent upon the other parameters. An approximate numerical method, using polynomial temperature profiles with time dependent coefficients, was used to solve the one dimensional heat conduction model. The dynamic behavior of the crust was predicted as a function of the experimental parameters. The local heat transfer coefficient on the freezing surface was estimated. There is reasonable agreement between the predicted and experimentally observed motions of the leading edge. DOE

N79-31575# Oak Ridge National Lab., Tenn.
THERMAL-GRADIENT MASS TRANSFER IN LITHIUM-STAINLESS STEEL SYSTEMS
P. F. Tortorelli and J. H. DeVan 1979 5 p refs Presented at 1st Topical Meeting on Fusion Reactor Materials, Miami Beach, Fla., 29 Jan. 1979
(Contract W-7405-eng-26)
(CONF-790125-39) Avail: NTIS HC A02/MF A01

The corrosion of type 316 stainless steel by flowing Li was studied as a function of time in thermal-convection loops. After a transient period, the corrosion rates were observed to be constant with time, with values ranging from 10 to 20 mg/sq m h. Preliminary analysis indicated that the corrosion rate is controlled by the diffusion of Fe through the liquid Li boundary layer. The deposition processes involved the formation of crystals of nearly pure Cr in the cold legs of the loops. DOE

N79-31576# Massachusetts Inst. of Tech., Cambridge. Dept. of Nuclear Engineering.
HEAT TRANSFER AND FLUID FLOW ASPECTS OF FUEL-COOLANT INTERACTIONS

M. L. Corradini Sep. 1978 530 p refs
(Contract EY-76-S-02-2781)
(COO-2781-12TR) Avail: NTIS HC A23/MF A01

A major portion of the safety analysis effort for the liquid metal fast breeder reactor is involved in assessing the consequences of a hypothetical core disruptive accident (HCDA). The thermal interaction of the hot fuel and the sodium coolant during the HCDA was investigated in two areas. A postulated loss of flow transient may produce a two-phase fuel at high pressures. The thermal interaction phenomena between fuel and coolant as the fuel is ejected into the upper plenum were investigated. A postulated transient overpower accident may produce molten fuel being released into sodium coolant in the core region. An energetic coolant vapor explosion for these reactor materials does not seem likely. However, experiments using other materials (e.g., Freon/water, tin/water) demonstrated the possibility of this phenomenon. DOE

N79-31577# Oak Ridge National Lab., Tenn.
HEAT PUMP MODELING Progress Report
R. D. Ellison, F. A. Creswick, C. K. Rice, W. L. Jackson, and S. K. Fischer 1979 25 p refs Presented at 4th Ann. Heat Pump Technol. Conf., Stillwater, Okla., 9 Apr. 1979
(Contract W-7405-eng-26)
(CONF-790446-4) Avail: NTIS HC A02/MF A01

Computer models of the performance of heat pumps and of individual components are described; preliminary results from system improvement studies using these models are presented. Heat exchanger models, based on a tube-by-tube computational approach, may be used by the system model when appropriate. Comparisons of calculated and observed performance parameters for heat exchangers in the laboratory are shown. DOE

N79-31578# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
MOTION OF PARTICLES IN A THERMAL BOUNDARY LAYER
R. W. Schefer, Y. Agrawal, R. K. Cheng, F. Robben, and L. Talbot 15 Jun. 1978 6 p refs Presented at the 3d Intern. Workshop on Laser Velocimetry, West Lafayette, Ind., 11-13 Jul. 1978
(Contract W-7405-eng-48)
(LBL-7843; Conf-780733-1) Avail: NTIS HC A02/MF A01

In the course of using laser Doppler velocimetry to study combustion in a thermal boundary layer, the particle count rate was found to decrease abruptly to zero inside the boundary layer. Experimental and theoretical investigation of this phenomenon was carried out. The motion of the particles may be due to the combined effects of thermophoresis and radiative heating. DOE

N79-31579# Los Alamos Scientific Lab., N. Mex.
M-3 SERIES ON DETONATION SCIENCE. 2: ONE DIMENSIONAL FLOW
W. Fickett May 1979 45 p refs
(Contract W-7405-eng-36)
(LA-7817-MS-Vol-2) Avail: NTIS HC A03/MF A01

An introduction to one dimensional nonreactive flow is presented. The plan of attack is to, in effect, take the equations apart and put them back together again, adding complications one by one as the reassembly proceeds. DOE

N79-31580# Oak Ridge National Lab., Tenn.
MASS TRANSFER IN TWO-PHASE NONDISPERSING LIQUID-LIQUID CONTACTORS WITH A HIGH-DENSITY-DIFFERENCE SYSTEM
C. H. Brown, Jr. Apr. 1979 105 p refs
(Contract W-7405-eng-26)
(ORNL/TM-6670) Avail: NTIS HC A06/MF A01

Mass transfer rates of an electrolyte through a turbulent aqueous film in an agitated two-phase nondispersing liquid-liquid contactor were measured using an aqueous electrolyte solution as the light phase and mercury as the heavy phase. The mass transfer rates were measured polarographically via the diffusion-limited, electrically driven reduction of quinone at the mercury surface in the contactor. The parameters proven to be most significant to the mass transfer rate were agitator speed, agitator diameter, and aqueous-phase viscosity. The correlation developed a new form of the intercept term which correlates mass transfer data over a much wider range of Sherwood numbers than that found in the literature. DOE

N79-31581# Societe Anonyme Belge de Constructions Aeronautiques, Brussels (Belgium).
DESIGN AND DEVELOPMENT OF A HIGH PERFORMANCE VARIABLE CONDUCTANCE HEAT PIPE, PHASE 2 Final Report
J. P. Mathieu and B. Moschetti Dec. 1978 109 p refs Prepared in cooperation with SNIAS, Cannes, France
(Contract ESTEC-3007/76-NL-PP(SC))
(H05/N1/79; ESA-CR(P)-1194) Avail: NTIS HC A06/MF A01

Variable conductance heat pipes (VCHP) and constant conductance heat pipes (CCHP) were designed as 100 watt/meter capillary systems. Design constraints included a 10 mm diameter and a temperature control passive system based on the cold reservoir technique. The manufacturing of two engineering prototypes, their heat transport and temperature control testing, and their submission to a defined test environment is reported on. The 100 watt/meter objective was attained both as CCHP and as VCHP, either in a straight or a curved configuration. Temperature control was also satisfactory, but the volume ratio required modification in light of experimentally determined parameters in order to meet the performance specification. Finally, both heat pipes survived the space environment tests as regards their heat transport performance and temperature control characteristics. Author (ESA)

N79-31582# Aeritalia S.p.A., Torino (Italy).
SURVEY OF SPACE RADIATOR SYSTEMS Final Report
L. Bussolino Nov. 1978 470 p
(Contract ESTEC-3378/77-NL-PP(SC))
(TASS-78-B-1814; ESA-CR(P)-1217) Avail: NTIS HC A20/MF A01

A survey of the state of the art of radiator systems was conducted and the design of various radiator concepts was analyzed, including the related interfaces. The treated subjects include location analysis, heat rejection and efficiency, thermal hydraulic and mechanical interfaces, analysis and design of fluid loops, heat pipe radiators, and hybrid concepts. A general comparison of the above cited concepts and an outline of problem areas to be developed is presented. Author (ESA)

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N79-31583# Texas Instruments, Inc., Dallas.
STUDY OF A NUCLEAR MAGNETIC RESONANCE (NMR) GYRO USING OPTICALLY PUMPED HELIUM ISOTOPES Final Technical Report, 1 Apr. 1978 - 31 Mar. 1979
Douglas D. McGregor 31 Mar. 1979 93 p refs
(Contract F49620-78-C-0056; AF Proj. 2305)
(AD-A070019; AFOSR-79-0728TR) Avail: NTIS HC A05/MF A01 CSCL 07/4

In this experimental investigation the polarization levels and relaxation rates for optically pumped 4 He and 3 He isotopes were determined. An experiment verified that simultaneous magnetic resonance of both isotopes in a common volume may be attained. Characteristics of some experimental semiconductor diode lasers were measured with a view toward replacing helium lamps as an optical pumping radiation source with diode lasers. A semiconductor diode laser was successfully used to monitor polarized 4 He atoms. GRA

N79-31584# James Ewing Hospital, New York, N. Y.
CALORIMETRY

J. C. McDonald 1978 31 p refs Presented at Workshop on Charged Particle Dosimetry, Los Alamos, N. Mex., 15 Mar. 1978
(Contract EY-76-S-02-3522)
(COO-3522-24; Conf-780388-1) Avail: NTIS HC A03/MF A01

The techniques and equipment currently employed for calorimetric dosimetry were briefly surveyed and the status of some recent measurements presented. The problems which remain to be investigated are: the thermal defect, the suitability of A-150 plastic as a material for heavy charged particle calorimetry and calorimeter designs that are appropriate for specific radiation situations, including cryogenic calorimeters. DOE

N79-31585# Sira Inst. Ltd., Chislehurst (England).
MEASUREMENT OF EMITTANCE AT CRYOGENIC TEMPERATURES, PHASE 1 REPORT
W. A. Henton-Jones, L. J. Cox, and A. Gilkes Jan. 1979 67 p refs
(Contract ESTEC-3567/78-NL-HI)
(SIRA-6/5187/00-0; ESA-CR(P)-1198) Avail: NTIS HC A04/MF A01

The initial studies for a program aimed at producing apparatus for the measurement of emittance of materials at cryogenic temperatures is presented. A detailed definition of the system elements and of the optical system, the test and calibration plan, and a target performance specification are included. The reasons for choosing the radiometric method are explained. A total hemispherical emittance mode of operation is adopted, although a scheme for measuring directional emittance at some future date is provided for in the cryostat construction.
Author (ESA)

N79-31586# Ferranti Ltd., Bracknell (England). Digital Systems Div.
ONBOARD SIGNAL PROCESSING, TECHNOLOGY AND SYSTEMS. VOLUME 1: SIGNAL PROCESSING OPERATIONS
D. J. Bonfield, J. R. Moon, J. R. E. Thomas, and D. W. Cruse Dec. 1977 227 p refs 4 Vol.
(Contract ESA-2896/76-HP)
(Rept-3066-Vol-1; ESA-CR(P)-1206-Vol-1) Avail: NTIS HC A11/MF A01

Work carried out with respect to typical algorithms to be implemented in the area of special purpose onboard spacecraft payload signal processing is presented. A comprehensive range of signal processing operations are examined from convolution through to analog to digital conversion, including correlation, the Fourier transform, linear discrete filters, windowing, number theoretic transforms, and statistical calculations. A number of other transforms are also considered, namely the chirp-Z, prime, Walsh, Haar, discrete cosine, slant, and Karhunen-Loeve. This latter transform, of importance in image data compression, is only discussed briefly since its implementation is examined in considerable detail in volume 3. For each topic a brief theoretical introduction is followed by a discussion of various methods of hardware realization, with references made to known implementations using advanced technological devices giving high speed of operation and low power consumption. Also included in this volume is a discussion of spectrum analysis including zooming and a comprehensive bibliography. Author (ESA)

N79-31587# Ferranti Ltd., Bracknell (England). Digital Systems Div.
ONBOARD SIGNAL PROCESSING, TECHNOLOGY AND SYSTEMS. VOLUME 2: SIGNAL PROCESSING TECHNOLOGIES
K. M. Harvey, M. J. Abraham, J. H. Harding, M. H. Wright, and D. W. Cruse Mar. 1978 471 p refs 4 Vol.
(Contract ESA-2896/76-HP)
(Rept-3134-Vol-2; ESA-CR(P)-1206-Vol-2) Avail: NTIS HC A20/MF A01

Work carried out with respect to descriptions of fundamentals of advances technologies and the applicability of these advances technologies to be processing operations outlined in volume 1 is presented. Both analog and digital technologies were considered and include, for example, charge coupled devices (analog and digital), surface acoustic waves (SAW), integrated injection logic, complementary MOS (CMOS), CMOS/SOS (silicon-on-sapphire), and many others. For each advanced technology considered, a brief historical introduction is given, followed by the principle of operation and construction, its applications, and future trends. The most relevant of these technologies are then discussed with regard to the applicability of the technologies to signal processing operations giving details of achievable performance and, where possible, direct comparisons of the technologies, particularly in respect to speed of operation and power consumption. Included in this volume as appendices are manufacturer's visit reports, selected component data sheets, definitions of technological terms, and a comprehensive bibliography. Author (ESA)

N79-31588# Ferranti Ltd., Bracknell (England). Digital Systems Div.
ONBOARD SIGNAL PROCESSING, TECHNOLOGY AND SYSTEMS. VOLUME 3: SIGNAL PROCESSING APPLICATIONS
D. J. Bonfield, J. R. E. Thomas, and D. W. Cruse Mar. 1978 66 p refs
(Contract ESA-2896/76-HP)
(Rept-3135-Vol-3; ESA-CR(P)-1206-Vol-3) Avail: NTIS HC A04/MF A01

Three separate reports, each describing a real-time processing system and discussing the applicability of advanced technologies to its implementation are presented. The first report is concerned with synthetic aperture radar (SAR) processing. Following a section dealing with the characteristics of the SAR signal, three sampled data system architectures suitable for performing the processing in real-time are introduced. Extensions to these architectures, required to allow range migration correction and subaperture processing to be performed, are then considered. Finally processor implementations are discussed based on a tentative specification. The second and third reports, describe the hardware implementation of the Karhunen-Loeve transform and a histogram clustering technique for image data compression, respectively. The main aim is to produce an implementation giving the lowest power consumption using advanced analog and digital technologies. The most promising approach seems to be a digital solution using custom SOS CMOS whereby an order of magnitude reduction, compared with present-day devices, can be achieved.
Author (ESA)

N79-31589# Ferranti Ltd., Bracknell (England). Digital Systems Div.
ONBOARD SIGNAL PROCESSING, TECHNOLOGY AND SYSTEMS. VOLUME 4: SIGNAL PROCESSING DEVICES: VISIT REPORTS, DATA SHEETS AND MANUFACTURERS ADDRESSES
K. M. Harvey, M. J. Abraham, M. H. Wright, and D. W. Cruse Mar. 1978 462 p 4 Vol.
(Contract ESA-2896/76-HP)
(Rept-3190-Vol-4; ESA-CR(P)-1206-Vol-4) Avail: NTIS HC A20/MF A01

Reports on visits made to manufacturers and research centers actively engaged in advanced technology development, such as metal oxide semiconductors, SOS semiconductors, and surface acoustic wave devices, are presented as the fourth part of a study on onboard spacecraft payload signal processing.
Author (ESA)

N79-31590# British Aerospace Dynamics Group, Bristol (England). Electronics and Space Systems.
STUDY OF OPTICAL PROCESSING OF IMAGE DATA ON BOARD SPACECRAFT Final Report
M. B. Brown, D. Thomas, and A. Levenston Apr. 1979 156 p refs
(Contract ESTEC-3455/77-NL-PP(SC))
(ESS/SS-936; ESA-CR(P)-1215) Avail: NTIS HC A08/MF A01

The possibility of performing optical processing of image data on board spacecraft was investigated in order to assess the effects of reducing the data transmission rate. A survey of optical processing techniques and potential applications is included. The optical processing arrangements are discussed and three systems are treated in detail. Further work is recommended for the spectral classifier and the model correlation systems,

since analysis can be performed in real time, and a detailed development program is proposed. Author (ESA)

N79-31591# National Technical Information Service, Springfield, Va.
APPLICATIONS OF HOLOGRAPHY, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1975 - May 1979
Brian Carrigan Jun. 1979 274 p Supersedes NTIS/PS-78/0561; NTIS/PS-77/0508; NTIS/PS-76/0452; NTIS/PS-75/431; COM-73-11958
(NTIS/PS-79/0566/4; NTIS/PS-78/0561; NTIS/PS-77/0508; NTIS/PS-76/0452; NTIS/PS-75/431; COM-73-11958) Avail: NTIS HC$28.00/MF$28.00 CSCL 14E

Studies on the applications of holography in such areas as photographing high-speed particles, nondestructive testing of material defects, strain analysis, microscopy, interferometry, vibration measurement, and medical diagnosis are presented. Flow visualization and acoustic holography are excluded, as is basic research on holographic theory and recording techniques. (This updated bibliography contains 266 abstracts, 38 of which are new entries to the previous edition.) GRA

N79-31592# National Technical Information Service, Springfield, Va.
HOLOGRAPHIC THEORY AND RECORDING TECHNIQUES. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - May 1979
Brian Carrigan Jun. 1979 240 p Supersedes NTIS/PS-78/0582; NTIS/PS-77/0534; NTIS/PS-76/0450; NTIS/PS-75/433; COM-74-10870
(NTIS/PS-79/0601/9; NTIS/PS-78/0582; NTIS/PS-77/0534; NTIS/PS-76/0450; NTIS/PS-75/433; COM-74-10870) Avail: NTIS HC $28.00/MF $28.00 CSCL 14E

The following topics on holography discuss the theory, equipment, materials, and recording techniques. Among the techniques cited are color holography, X-ray holography, high speed holography, and motion picture holography. Techniques for image motion compensation, image deblurring, wavefront reconstruction, and resolution are also cited. (This updated bibliography contains 234 abstracts, 31 of which are new entries to the previous edition.) GRA

N79-31675# Centre National de la Recherche Scientifique, Verrieres-le-Buisson (France). Lab. de Physique Stellaire et Planetaire.
DEVELOPMENT OF A HIGH RESOLUTION ULTRAVIOLET SOLAR SPECTROGRAPH TO BE LAUNCHED ON A BALLOON EQUATORIAL PLATFORM
P. Lemaire and D. Samain *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 283-286 refs (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

N79-31677# Max-Planck-Institut fuer Extraterrestrische Physik, Garching (West Germany).
BALLOON EXPERIMENT FOR THE OBSERVATION OF COSMIC X-RAY SOURCES
W. Pietsch, C. Reppin, J. Truemper, W. Voges, E. Kendziorra (Tuebingen Univ.), and R. Staubert (Tuebingen Univ.) *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 293-297 refs (For primary document see N79-31637 22-42)
(Grants DFG-Tr-11/14; DFG-Tr-11/15)
Avail: NTIS HC A23/MF A01

N79-31702# Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany).
PERFORMANCE OF APPARATUS AND EQUIPMENT IN TEXUS 1
J. E. Geisel and B. J. Franke *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 467-474 (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

36 LASERS AND MASERS

Includes parametric amplifiers.

N79-31593# Indiana Univ. at Bloomington. Dept. of Chemistry.
WIDE-BANDWIDTH ANALOG CORRELATOR AND ITS APPLICATION TO MODE-LOCKED LASER MEASUREMENTS
J. M. Ramsey, G. M. Hieftje, and G. R. Haugen 10 May 1979 23 p refs
(Contract N00014-76-C-0838)
(AD-A069497; TR-19) Avail: NTIS HC A02/MF A01 CSCL 20/5

A new instrument for the analog determination of correlation functions of wide-bandwidth signals is described and characterized. The instrument is comprised of microwave electronic components; a double-balanced mixer performs the multiplication operation involved in the correlation process whereas a constant-impedance line stretcher introduces the variable delay. Measurements indicate that the correlator has a bandwidth of approximately 4 GHz. It is shown that this inexpensive and simple device can be used as a diagnostic tool for mode-locked argon-ion lasers when used in conjunction with a fast photodiode detector. GRA

N79-31594# Textron Bell Aerospace Co., Buffalo, N. Y.
VISIBLE CHEMICAL LASER DEVELOPMENT Final Technical Report, Jan. - Dec. 1978
Jay A. Blauer, Warren F. Brandkamp, and Wayne C. Solomon May 1979 37 p refs
(Contract DASG60-78-C-0030)
(AD-A069284) Avail: NTIS HC A03/MF A01 CSCL 20/5

Experimental data are presented relative to attempts to induce laser oscillations in the vicinity of 5578 A in a chemically prepared tin oxide medium. Atomic tin was first prepared by shock-heating mixtures of SnCl4 in Argon. The plenum gases were accelerated through a nozzle bank and molecular N2O was injected into the supersonic flow stream. Medium diagnostics were conducted in a windowed section downstream of the nozzle exit plane. During the course of these studies, it was found that atomic chlorine, a fragment of SnCl4 dissociation, proved very deleterious to the retention of SnO (a3 Sigma(-)) excited molecules within the medium. To overcome this difficulty, the tin vapor was prepared by entraining within the oncoming shock wave the products of an exploding tin wire. This permitted over a 100 fold increase in the concentration of excited species. To date, all attempts to induce laser oscillations within the chemically prepared medium have been unsuccessful. Computer modeling of the system indicates that the major reasons for this failure were that the medium temperature was far too high, and that the density of tin vapor must be increased about three fold. Data are presented relative to number density measurements for SnO(a3 Sigma(-)) under a variety of experimental conditions and to the several attempts to induce laser oscillations within the seemingly optimized medium. GRA

N79-31595# Illinois Univ. at Urbana-Champaign. Electro-Physics Lab.
NEAR MILLIMETER WAVE STUDY-COMPONENTS Final Report, 1 Aug. 1977 - 20 Jan. 1979
T. A. DeTemple May 1979 28 p refs
(Contract DAAG29-77-C-0025)
(AD-A069302; UILU-ENG-79-2551; ARO-15261.2-A-P) Avail: NTIS HC A03/MF A01 CSCL 20/5

The generation of short far infrared pulses by using a mode-locked CO2 pump laser is explored experimentally and theoretically. It is demonstrated that pulses of ~1 nsec are obtainable from CH3F at 496 micron and D2O at 385 micron. Theoretical estimates indicate the possibility of pulses in the 300-600 psec range with a conversion efficiency comparable to the Manley-Rowe limit. GRA

N79-31596# Naval Research Lab., Washington, D. C.
THE NON-LINEAR THEORY OF EFFICIENCY ENHANCEMENT IN THE ELECTRON CYCLOTRON MASER
P. Sprangle and Robert A. Smith 18 Apr. 1979 27 p refs
(XF54581007)

(AD-A069461; NRL-MR-3983) Avail: NTIS HC A03/MF A01 CSCL 20/5

We present a nonlinear analysis of the single particle dynamics in an electron cyclotron maser oscillator and show that the efficiency can be dramatically enhanced by appropriately contouring the system parameters. The beam electrons can be prebunched in phase to form a macro-particle in phase space such that beam kinetic energy is not extracted. After forming a phase bunched electron beam, either the applied magnetic field or the cavity electromagnetic field can be spatially varied in such a way as to extract virtually all the electron transverse kinetic energy. Without such contouring, the transverse efficiency is typically less than or = to 40%. An example is presented in which the transverse efficiency is increased from 36% (in uniform fields) to 75% by increasing the applied magnetic field by about 6%. The present analysis can readily be extended to the case of a maser amplifier. GRA

N79-31597# Air Force Academy, Colo. Research Lab.
CHEMICAL GENERATION OF 02((1) DELTA SUB G) I Interim Report, 1 Dec. 1977 - 18 Dec. 1978
Lee E. Myers, L. P. Davis, C. J. Dymek, H. L. Pugh, and K. D. Rachocki May 1979 41 p refs
(AF Proj. 2303)
(AD-A069801; FJSRL-TR-79-0005) Avail: NTIS HC A03/MF A01 CSCL 20/5

Production of singlet delta oxygen has been measured with electron spin resonance spectroscopy. A chemical reaction between chlorine and basic hydrogen peroxide was used to produce the excited oxygen. Several chemical and physical parameter variations were studied and analyzed on the basis of the fraction of singlet delta oxygen in the total oxygen product gas. Author (GRA)

N79-31598# Sandia Labs., Albuquerque, N. Mex.
MAGNITUDE AND RANGE DEPENDENCE OF LASER RADAR SIGNALS RETROFLECTED FROM TOPOGRAPHIC TARGETS
P. J. Hargis, Jr., J. P. Hohimer, and R. L. Hughes Sep. 1978 84 p refs
(Contract EY-76-C-04-0789)
(SAND-78-1571) Avail: NTIS HC A05/MF A01

A coaxial Nd:YAG radar which could operate at wavelengths of 1.064 microns and 0.532 microns was used to measure the magnitude and range dependence of laser radar signals retroreflected from a wide variety of topographic targets. Measurements were made at three target ranges for all of the targets and at six target ranges for two selected targets. The values measured for the specular and diffuse reflectivities lead to large specular signal enhancements when a downward looking laser radar at satellite altitudes is used to detect the component of laser radiation retroreflected by the earth's surface. DOE

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N79-31599 British Library Lending Div., Boston Spa (England).
WELDING OF NIOCIUM-STABILIZED 2.25Cr-1Mo STEEL FOR FAST REACTOR STEAM GENERATORS
G. B. Dusi, U. Foli, and F. Nenci 30 Jan. 1979 47 p refs Transl. into ENGLISH from Com. Nac. Energ. Nucl., RT/MET (Italy), v. 77, no. 1
(BLL-Risley-TR-3285-(9091.9F)) Copyright. Avail: British Library Lending Div., Boston Spa, Engl.

Welding 2.25Cr-1Mo-Nb steel presents a problem due to embrittlement in the weld and surrounding area. A general rule adopted by the CRBRP for the nonstabilized version of the steel, is that of using only extremely pure materials free of inclusions obtained with the VAR or ESR methods. This is based on the calculation of an embrittlement coefficient which is proportional to the content of impurities such as Sb, Sn, As and in particular P(2). An accurate choice of operating parameters and heat treatments both before and after welding makes it possible to obtain satisfactory results. Before the results obtained from experiments are given, a brief summary follows of some of the work which was done in this field. G.Y.

N79-31600 British Library Lending Div., Boston Spa (England).
EDDY CURRENT TESTING OF AUSTENITIC WELDS, CLADDING AND CAST MATERIALS
Werner Meier 24 Jan. 1979 12 p refs Transl. into ENGLISH from Materialpruefung (West Germany), v. 20, no. 2, Feb. 1978 p 57-62
(BLL-Windscale-802-(9091.9F)) Avail: British Library Lending Div., Boston Spa, Engl.

Using the eddy current test and examination procedure, The geometric position of flaws can be determined in nonferromagnetic workpieces. To what extent the flaws can be recognized in this case depends on their type and size. A change in the genesis of crystalline structure always affects the electric conductivity and consequently the test results. Austenitic steel can in addition contain delta-ferrite, which produces local changes in the permeability. Tests show that by choosing suitable test frequencies and skillful guidance of the probes the effect on the test results can be kept to a relative minimum. Author

N79-31601*# National Aeronautics and Space Administration, Washington, D. C.
STRENGTH OF ADHESIVE-BONDED HYBRID STRUCTURES
L. Kirschke, R. Prinz, and H. Schnell Jun. 1979 39 p refs Transl. into ENGLISH from "Festigkeit geklebter hybridstrukturen" DFVLR, Darmstadt, 19-23 Sep. 1978, DGLR paper-78-180 36 p Original language document was announced as A79-20021 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75488; DGLR-Paper-78-180) Avail: NTIS HC A03/MF A01 CSCL 11D

Structures prepared from materials with different thermal and mechanical properties by means of fiber-strengthened binders can fail in a number of ways. The present lecture is focused on failures through debonding at the metal or at the fiber-reinforced plastic. A method for calculating the stress distribution in adhesive layers as a function of the load is outlined, and its usefulness in providing insight into the behavior of bonds in hybrid structures is noted. Means of eliminating the unfavorable effects of temperature, humidity, creep and relaxation on the bonds in the manufacture of hybrid structures are examined, along with test methods developed for such structures. Author

N79-31602*# Pratt and Whitney Aircraft Group, East Hartford, Conn. Commercial Products Div.
DEVELOPMENT OF A PLASMA SPRAYED CERAMIC GAS PATH SEAL FOR HIGH PRESSURE TURBINE APPLICATIONS Final Report, 12 Sep. 1978 - 12 Apr. 1979
L. T. Shiembob and J. F. Hyland Sep. 1979 43 p
(Contract NAS3-21390)
(NASA-CR-159669; PWA-5633-11) Avail: NTIS HC A03/MF A01 CSCL 11A

Development of the plasma sprayed graded, layered ZrO2/CoCrAlY seal system for gas turbine engine blade tip seal application up to 1589 K (2400 F) surface temperature was continued. Methods of improvement of the cyclic thermal shock resistance of the sprayed zirconia seal system were investigated. The most promising method, reduction of the ceramic thickness and metallic substrate stiffness were selected based upon potential and feasibility. Specimens were fabricated and experimentally evaluated to: (1) substantiate the capacity of the geometry changes to reduce operating stresses in the sprayed structure; and (2) define the abradability, erosion, thermal shock and physical property characteristic for the sprayed ceramic seal system. Thermal stress analysis was performed and correlated with thermal shock test results. Author

N79-31603*# Mechanical Technology, Inc., Latham, N. Y.
DESIGN AND APPLICATION OF A TEST RIG FOR SUPERCRITICAL POWER TRANSMISSION SHAFTS Final Report
M. Darlow and A. Smalley Washington NASA Aug. 1979 168 p refs
(Contract NAS3-16824)
(NASA-CR-3155; MTI-78TR41) Avail: NTIS HC A08/MF A01 CSCL 13I

The design, assembly, operational check-out and application of a test facility for testing supercritical power transmission shafts under realistic conditions of size, speed and torque are described. Alternative balancing methods and alternative damping mechanisms are demonstrated and compared. The influence of torque upon the unbalance distribution is studied, and its effect on synchronous vibrations is investigated. The feasibility of operating supercritical power transmission shafting is demonstrated, but the need for careful control, by balancing and damping, of synchronous and nonsynchronous vibrations is made clear. The facility was demonstrated to be valuable for shaft system development programs and studies for both advanced and current-production hardware. G.Y.

N79-31604*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EVALUATION OF HIGH-CONTACT-RATIO SPUR GEARS WITH PROFILE MODIFICATION
Dennis P. Towsend, Berl B. Baber (Southwest Research Inst., San Antonio, Tex.), and Andrew Nagy (Southwest Research Inst., San Antonio, Tex.) Sep. 1979 24 p refs
(NASA-TP-1458; E-9949) Avail: NTIS HC A02/MF A01 CSCL 13I

Scoring tests, surface fatigue tests, and single-tooth bending fatigue tests were conducted with four sets of spur gears of standard design and three sets of spur gears of new-tooth-form design. The new-tooth-form and standard gears scored at approximately the same gear bulk temperature of 409 K (277 F). The scoring load for the new-tooth-form gears was 22 percent less than that for the standard gears. The pitting fatigue lives of the standard and new-tooth-form gears were statistically equal for equal Hertz stress, while the surface fatigue life of the nw-tooth-form gears was approximately five times that of the standard gears at the same load. The standard gears failed at a 17 percent higher bending stress than the new-tooth-form gears when stress was calculated by the AGMA method. However, the difference is not statistically significant. The standard gears failed at a tooth load 1.9 times that for the new-tooth-form gears. Author

N79-31605*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FERROGRAPHIC ANALYSIS OF WEAR DEBRIS FROM FULL-SCALE BEARING FATIGUE TESTS
William R. Jones, Jr. and Stuart H. Loewenthal Sep. 1979 19 p refs
(NASA-TP-1511; E-9827) Avail: NTIS HC A02/MF A01 CSCL 13I

The Ferrograph was used to determine the types and quantities of wear particles generated during full scale bearing fatigue tests. Deep-groove ball bearings made from steel were used. A tetraester lubricant was used in a recirculating lubricant system containing a 49 micrometers absolute filter. Test conditions include a maximum Hertz stress of 2.4 GPa, a shaft speed of 15,000 rpm, and a lubricant supply temperature of 74 C (165 F). Four fatigue failures were detected by accelerometers in this test set. In general, the Ferrograph was more sensitive (up to 23 hr) in detecting spall initiation than either accelerometers or the normal sepectrographic oil analysis. Four particle types were observed: normal rubbing weather particles, spheres, nonferrous particles, and severe wear (spall) fragments. Author

N79-31606# Central Inst. for Industrial Research, Oslo (Norway).
DEVELOPMENT AND ENGINE TESTING OF COATINGS ON DIESEL ENGINE COMPONENTS Technical Report, Jan. - Dec. 1978
Ingard Kvernes, Per Fartum, and Rolf Henriksen Feb. 1979 35 p refs
(Contract ET-78-X-01-4288)
(HCP/T-4288) Avail: NTIS HC A03/MF A01

A series of coatings were tested in a laboratory combustion test rig in order to select coatings for further testing on valves and pistons onboard ships. These coatings bonded well to the base material, but had different corrosion resistance. A nickel-chromium-aluminum-yttrium alloy proved to be the best alloy coatings as far as corrosion resistance is concerned. High proportion of oxide in a metal coating did increase the corrosion rate. Coatings of nickel-chromium-aluminum-yttrium alloy with an intermediate layer of chromium and a top coat of yttria stabilized zirconia show no sign of corrosion of cracks even after 120 hours testing in the combustion rig or after 6000 hours on a valve plate in a large bore diesel engine in service. DOE

N79-31607# Massachusetts Inst. of Tech., Cambridge.
MODELLING STUDY OF THE FUEL CONSUMPTION AND NO(SUB x) EMISSIONS OF SPARK IGNITION ENGINES OVER A RANGE OF DESIGN AND OPERATING CONDITIONS
J. B. Heywood, R. J. Tabaczynski, J. M. Higgins, and P. A. Watts Jul. 1978 101 p refs
(Contracts EY-76-S-02-2881; DOT-TSC-1034)
(HCP/M-2881) Avail: NTIS HC A06/MF A01

A computer simulation of the four-stroke spark-ignition engine cycle was developed for studies of the effects of variations in engine design and operating parameters on engine performance, efficiency, and NO emissions. The simulation computes the flows into and out of the engine, calculates the changes in thermodynamic properties and composition of the unburned and burned gas mixtures within the cylinder through the engine cycle due to work, heat and mass transfers, and follows the kinetics of NO formation and decomposition in the burned gas. DOE

N79-31608# Oak Ridge Y-12 Plant, Tenn.
COMPUTER AUTOMATION OF AN ELECTRON-BEAM WELDER
C. M. Davenport 1979 23 p refs Presented at Cam-I Intern. Spring Seminar, New Orleans, 9-13 Apr. 1979
(Contract W-7405-eng-26)
(Y/DA-8239; Conf-790435-1) Avail: NTIS HC A02/MF A01

An existing Hamilton Standard 7.5-kW electron-beam welder was upgraded and computer automated for precision production welding of parts of revolution. The new unit can repeatably produce multipass, wirefed welds on a time scale which is too fast for a manual operator's responses. Extensive rebuilding or replacement was required for nearly all the original equipment on the unit. A PDP-11/50 computer was installed to provide automatic sequencing through a weld procedure, as indicated in a specified stored file. Storage, editing, and listing of weld procedure files are provided by means of simple computer terminal inputs. DOE

N79-31609# Oak Ridge Y-12 Plant, Tenn.
INTERFACING THE LINEAR MOTOR SLIDE DRIVE TO A PRECISION MACHINE TOOL
W. E. Barkman, R. J. Brown, H. L. Gerth, and W. L. Green Apr. 1979 15 p refs
(Contract W-7405-eng-26)
(Y-2180) Avail: NTIS HC A02/MF A01

A linear-motor slide-drive system was used to replace the mechanical gear train on a large-component diamond-turning lathe. Inaccuracies in the previous lead-screw drive system resulted in cyclic errors of 0.25 to 2.5 micrometers which corresponded to the pitch of the screw. These cyclic errors were eliminated, and the machine is presently being used to successfully fabricate reflective metal optics. DOE

N79-31610# Westinghouse Electric Corp., Pittsburgh, Pa. Advanced Reactors Div.
SIMPLIFIED DESIGN METHODS FOR NONLINEAR DYNAMIC MECHANICAL SYSTEMS
T. M. Frick 1979 33 p Presented at the 3d Canadian Conf. on Earthquake Eng., Montreal, 4 Jun. 1979
(Contract EY-76-C-15-2395)
(CONF-790608-1) Avail: NTIS HC A03/MF A01

Dimensional analysis and classical methods are combined in a novel way to develop a simplified mathematical description of two practical nonlinear mechanical systems experiencing excitation similar to that due to an earthquake. This method is used to obtain system descriptions in closed algebraic form with appropriate constants. Predictions based on application of the method are made. Comparison of these predictions to results obtained from time-history solutions show the method is a valuable design tool. Application of the method to other systems is briefly discussed. DOE

N79-31611# National Centre of Tribology, Risley (England). European Space Tribology Lab.
ROD-END BEARING EVALUATION
K. Parker Jun. 1978 37 p refs
(Contract ESA-2588/75-MD)
(ESA-CR(P)-1179) Avail: NTIS HC A03/MF A01

Three types of dry-lubricated spherical rod-end bearings were selected for testing in air and vacuum with the load and rotational speed being typical of the expected operating conditions of such bearings in a satellite mechanism. The mechanical design of these bearings is described together with a list of the materials used in their construction. Six bearings of each type were obtained, which were initially tested in air for 3000 revolutions to evaluate such parameters as torque, radial backlash, and wear. Following a comparison of the results of these air tests, selected bearings were further tested in vacuum over the temperature range -70 C to +70 C. While there was a variation of torque with temperature, the significant result of the vacuum tests was that the torque and wear of the bearings were not degraded in vacuum. Finally, some recommendations for the use of this type of bearing are given. Author (ESA)

N79-31612# British Aerospace Dynamics (Space), Stevenage (England).
DESIGN STUDY AND DEVELOPMENT OF A MAGNETIC BEARING SCANNING MECHANISM (MBSM) FOR OPTICAL SENSOR APPLICATIONS, PHASE 1 Final Report
A. J. Harrison and M. Saka Jan. 1979 169 p
(Contract ESA-3606/78-NL-AK)
(TP-7721; ESA-CR(P)-1188) Avail: NTIS HC A08/MF A01

The design of a magnetic bearing scanning mechanism for optical sensor applications was studied. Trade-offs and performance analyses were carried out in the critical areas of magnetic bearings, motors, angular encoders, dynamic stability, and control electronics. Comparison is made with a target specification and an overall, optimum design concept is established to an extent that would allow detailed design, manufacture, and testing. Author (ESA)

N79-31613# National Centre of Tribology, Risley (England). European Space Tribology Lab.
FRICTIONAL TORQUE OF ANGULAR CONTACT BALL BEARINGS WITH DIFFERENT CONFORMITIES
M. J. Todd and K. T. Stevens Jul. 1978 43 p refs
(Contract ESA-2584/75-MD)
(ESA-CR(P)-1221) Avail: NTIS HC A03/MF A01

A model for predicting the frictional (or Coulomb)torque in any axially loaded, angular-contact ball bearing, when viscous drag from the lubricant can be neglected, was assessed by comparison with measurement. Calculations from the model, which assumes for simplicity that there is full slip in the spinning/rolling contact, give predicted torques in reasonable agreement with measured torques over a range of ball-to-race conformities. Agreement is improved at very low conformity by taking into account the partial slip conditions. However, for most practical bearings of this type the assumption of full slip is a good approximation and ball spin is the dominant contribution to torque. Results show the torque advantage of decreasing the conformity at constant bearing load, but they also demonstrate that this advantage is lost if the bearing is required to have a constant axial stiffness. The variation in contact angle with load and the fricational contribution of the cage were taken into account. The measured sliding friction coefficients for three types of lubricant were used in the calculations. Author (ESA)

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N79-31614*# Vought Corp. Advanced Technology Center, Inc., Dallas, Tex.
FATIGUE LIFE PREDICTION OF BONDED PRIMARY JOINTS Final Report, 1 Feb. 1978 - 15 Mar. 1979
J. F. Knauss Sep. 1979 78 p refs
(Contract NAS1-15188)
(NASA-CR-159049; ATC-R-92100/9CRL-17) Avail: NTIS HC A05/MF A01 CSCL 14D

The validation of a proposed fatigue life prediction methodology was sought through the use of aluminum butt and scarf joint and graphite/epoxy butt joint specimens in a constant amplitude fatigue environment. The structural properties of the HYSOL 9313 adhesive system were obtained by mechanical test of molded heat adhesive specimens. Aluminum contoured double cantilever beam specimens were used to generate crack velocity versus stress intensity factor data. The specific objectives were: (1) to ascertain the feasibility of predicting fatigue failure of an adhesive in a primary bonded composite structure by incorporating linear elastic crack growth behavior; and (2) to ascertain if acoustic emission and/or compliance measurement techniques can be used to detect flaws. G.Y.

N79-31615# Pittsburgh Univ., Pa. Dept. of Mathematics and Statistics.
MULTIVARIATE CLASSES IN RELIABILITY THEORY
Henry W. Block and Thomas H. Savits Oct. 1978 17 p refs
(Contract N00014-76-C-0839; Grant NSF MCS-577-01458)
(AD-A069308; RR-78-03) Avail: NTIS HC A02/MF A01 CSCL 12/1

Four classes of lifetimes which have been useful in describing situations where systems are assumed to have independent univariate component lifetimes are: the increasing failure rate (IFR) class; the increasing failure rate average (IFRA) class; the new better than used (NBU) class; and the new better than used in expectation (NBUE) class. These classes are reviewed and also multivariate analogs of the IFR and IFRA cases are discussed. New multivariate definitions of NBU and NBUE are introduced. Author (GRA)

N79-31616# Battelle Pacific Northwest Labs., Richland, Wash.
ANALYSIS OF VARIOUS NDT TECHNIQUES TO DETERMINE THEIR FEASIBILITY FOR DETECTING THIN LAYERS OF FERRITE ON TYPE 316 STAINLESS STEEL
G. B. Dudder, D. G. Atteridge, and T. J. Davis Sep. 1978 30 p refs
(Contract EY-76-C-06-1830)
(PNL-2805) Avail: NTIS HC A03/MF A01

The applicability of various NDT techniques for detecting thin layers of ferrite on type 316 stainless steel cladding was studied. The ferrite detection potential of each of the proposed NDT techniques was theoretically determined. Proof-of-principle experiments were conducted along with in-hot cell testing on actual EBR-II fuel pins. The electromagnetic technique was successfully demonstrated on actual fuel pins irradiated in EBR-II. Results of this technique screening study indicates that an electromagnetic and/or heat tinting layer NDT technique should be readily adaptable to hot cell inspection requirements. DOE

N79-31617# National Technical Information Service, Springfield, Va.
INFRARED TECHNIQUES FOR NONDESTRUCTIVE TESTING. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Mar. 1979
Guy E. Habercom, Jr. Jun. 1979 116 p Supersedes NTIS/PS-78/0358
(NTIS/PS-79/0519/3; NTIS/PS-78/0358) Avail: NTIS HC $28.00/MF $28.00 CSCL 14B

Fundamental principles of nondestructive testing and inspection, by use of infared devices, are investigated in these Federally-funded research reports. Tire flaws, electronics circuit defects, and flaws in bonded surfaces are among the applications researched. (This updated bibliography contains 110 abstracts, 4 of which are new entries to the previous edition). GRA

N79-31618# National Technical Information Service, Springfield, Va.
INFRARED TECHNIQUES FOR NONDESTRUCTIVE TESTING. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Mar. 1979
Guy E. Habercom, Jr. Jun. 1979 115 p Supersedes NTIS/PS-78/0359
(NTIS/PS-79/0520/1; NTIS/PS-78/0359) Avail: NTIS

HC $28.00/MF $28.00 CSCL 14B

Fundamental principals of nondestructive testing and inspection, by use of infrared devices, are investigated in these reports gathered from a worldwide literature survey. Tire flaws, electronic circuit defects, and flaws in bonded surfaces are among the applications researched. This updated bibliography contains 110 abstracts, 2 of which are new entries to the previous edition.

GRA

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N79-31619*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

STRAINRANGE PARTITIONING LIFE PREDICTIONS OF THE LONG TIME METAL PROPERTIES COUNCIL CREEP-FATIGUE TESTS

J. F. Saltsman and G. R. Halford 1979 34 p refs Proposed for presentation at the Winter Ann. Meeting, N. Y., 2-7 Dec. 1979; sponsored by Am. Soc. of Mech. Engr.

(NASA-TM-79260; E-174) Avail: NTIS HC A03/MF A01 CSCL 20K

The method of strainrange partitioning is used to predict the cyclic lives of the Metal Properties Council's long time creep-fatigue interspersion tests of several steel alloys. Comparisons are made with predictions based upon the time- and cycle-fraction approach. The method of strainrange partitioning is shown to give consistently more accurate predictions of cyclic life than is given by the time- and cycle-fraction approach.

Author

N79-31620*# Boeing Commercial Airplane Co., Seattle, Wash.

ATLAS, AN INTEGRATED STRUCTURAL ANALYSIS AND DESIGN SYSTEM. VOLUME 1: ATLAS USER'S GUIDE

Rodney L. Dreisbach, ed. Jul. 1979 357 p refs

(Contract NAS1-12911)

(NASA-CR-159041; D6-25400-0001-Vol-1) Avail: NTIS HC A16/MF A01 CSCL 20K

Some of the many analytical capabilities provided by the ATLAS Version 4.0 System in the logical sequence are described in which model-definition data are prepared and the subsequent computer job is executed. The example data presented and the fundamental technical considerations that are highlighted can be used as quides during the problem soloving process. This guide does not describe the details of the ATLAS capabilities, but provides an introduction to the new user of ATLAS to the level at which the complete array of capabilities described in the ATLAS User's Manual can be exploited fully. G.Y.

N79-31621*# Boeing Commercial Airplane Co., Seattle, Wash.

ATLAS, AN INTEGRATED STRUCTURAL ANALYSIS AND DESIGN SYSTEM. VOLUME 2: SYSTEM DESIGN DOCUMENT

W. J. Erickson, ed. Jul. 1979 464 p refs

(Contracts NAS1-12911; DAAG46-75-C-0072)

(NASA-CR-159042; D6-25400-0002-Vol-2) Avail: NTIS HC A20/MF A01 CSCL 20K

ATLAS is a structural analysis and design system, operational on the Control Data Corporation 6600/CYBER computers. The overall system design, the design of the individual program modules, and the routines in the ATLAS system library are described. The overall design is discussed in terms of system architecture, executive function, data base structure, user program interfaces and operational procedures. The program module sections include detailed code description, common block usage and random access file usage. The description of the ATLAS program library includes all information needed to use these general purpose routines. G.Y.

N79-31622*# Boeing Commercial Airplane Co., Seattle, Wash.

ATLAS, AN INTEGRATED STRUCTURAL ANALYSIS AND DESIGN SYSTEM. VOLUME 3: USER'S MANUAL, INPUT AND EXECUTION DATA

Rodney L. Dreisbach, ed. Jul. 1979 698 p refs

(Contracts NAS1-12911; DAAG46-75-C-0072)

(NASA-CR-159043; D6-25400-0003-Vol-3) Avail: NTIS HC A99/MF A01 CSCL 20K

The input data and execution control statements for the ATLAS integrated structural analysis and design system are described. It is operational on the Control Data Corporation (CDC) 6600/CYBER computers in a batch mode or in a time-shared mode via interactive graphic or text terminals. ATLAS is a modular system of computer codes with common executive and data base management components. The system provides an extensive set of general-purpose technical programs with analytical capabilities including stiffness, stress, loads, mass, substructuring, strength design, unsteady aerodynamics, vibration, and flutter analyses. The sequence and mode of execution of selected program modules are controlled via a common user-oriented language.

G.Y.

N79-31623*# Boeing Commercial Airplane Co., Seattle, Wash.

ATLAS, AN INTEGRATED STRUCTURAL ANALYSIS AND DESIGN SYSTEM. VOLUME 4: RANDOM ACCESS FILE CATALOG

Frederic P. Gray, Jr., ed. Jul. 1979 559 p refs

(Contract NAS1-12911; DAAG46-75-C-0072)

(NASA-CR-159044; D6-25400-0004-Vol-4) Avail: NTIS HC A24/MF A01 CSCL 20K

A complete catalog is presented for the random access files used by the ATLAS integrated structural analysis and design system. ATLAS consists of several technical computation modules which output data matrices to corresponding random access file. A description of the matrices written on these files is contained herein. Author

N79-31624*# Boeing Commercial Airplane Co., Seattle, Wash.

ATLAS, AN INTEGRATED STRUCTURAL ANALYSIS AND DESIGN SYSTEM. VOLUME 5: SYSTEM DEMONSTRATION PROBLEMS

R. A. Samuel, ed. Jul. 1979 271 p refs

(Contracts NAS1-12911; DAAG46-75-C-0072)

(NASA-CR-159045; D6-25400-0005-Vol-5) Avail: NTIS HC A12/MF A01 CSCL 20K

One of a series of documents describing the ATLAS System for structural analysis and design is presented. A set of problems is described that demonstrate the various analysis and design capabilities of the ATLAS System proper as well as capabilities available by means of interfaces with other computer programs. Input data and results for each demonstration problem are discussed. Results are compared to theoretical solutions or experimental data where possible. Listings of all input data are included. G.Y.

N79-31625*# Boeing Commercial Airplane Co., Seattle, Wash.

ATLAS, AN INTEGRATED STRUCTURAL ANALYSIS AND DESIGN SYSTEM. VOLUME 6: DESIGN MODULE THEORY

Bjorn F. Backman Jul. 1979 79 p refs

(Contracts NAS1-12911; DAAG46-75-C-0072)

(NASA-CR-159046; D6-25400-0006-Vol-6) Avail: NTIS HC A05/MF A01 CSCL 20K

The automated design theory underlying the operation of the ATLAS Design Module is decribed. The methods, applications and limitations associated with the fully stressed design, the thermal fully stressed design and a regional optimization algorithm are presented. A discussion of the convergence characteristics of the fully stressed design is also included. Derivations and concepts specific to the ATLAS design theory are shown, while conventional terminology and established methods are identified by references. G.Y.

N79-31626*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

A CRITICAL EXAMINATION OF STRESSES IN AN ELASTIC SINGLE LAP JOINT

Paul A. Cooper and James Wayne Sawyer Sep. 1979 61 p refs

(NASA-TP-1507; L-12802) Avail: NTIS HC A04/MF A01

CSCL 20K

The results of an approximate nonlinear finite-element analysis of a single lap joint are presented and compared with the results of a linear finite-element analysis, and the geometric nonlinear effects caused by the load-path eccentricity on the adhesive stress distributions are determined. The results from finite-element, Goland-Reissner, and photoelastic analyses show that for a single lap joint the effect of the geometric nonlinear behavior of the joint has a sizable effect on the stresses in the adhesive. The Goland-Reissner analysis is sufficiently accurate in the prediction of stresses along the midsurface of the adhesive bond to be used for qualitative evaluation of the influence of geometric or material parametric variations. Detailed stress distributions in both the adherend and adhesive obtained from the finite-element analysis are presented to provide a basis for comparison with other solution techniques. Author

N79-31627*# Lehigh Univ., Bethlehem, Pa. Inst. of Fracture and Solid Mechanics.

NORMAL AND RADIAL IMPACT OF COMPOSITES WITH EMBEDDED PENNY-SHAPED CRACKS Interim Report

G. C. Sih Feb. 1979 54 p refs

(Grant NsG-3179)

(NASA-CR-159538; IFSM-79-99) Avail: NTIS HC A04/MF A01

A method is developed for the dynamic stress analysis of a layered composite containing an embedded penny-shaped crack and subjected to normal and radial impact. The material properties of the layers are chosen such that the crack lies in a layer of matrix material while the surrounding material possesses the average elastic properties of a two-phase medium consisting of a large number of fibers embedded in the matrix. Quantitatively, the time-dependent stresses near the crack border can be described by the dynamic stress intensity factors. Their magnitude depends on time, on the material properties of the composite and on the relative size of the crack compared to the composite local geometry. Results obtained show that, for the same material properties and geometry of the composite, the dynamic stress intensity factors for an embedded (penny-shaped) crack reach their peak values within a shorter period of time and with a lower magnitude than the corresponding dynamic stress intensity factors for a through-crack. Author

N79-31628*# Rockwell International Corp., Downey, Calif.

ACTIVELY COOLED PLATE FIN SANDWICH STRUCTURAL PANELS FOR HYPERSONIC AIRCRAFT Final Report

L. M. Smith and C. S. Beuyukian Washington NASA Aug. 1979 172 p refs

(Contract NAS1-13382)

(NASA-CR-3159; SD-78-AP-0074) Avail: NTIS HC A08/MF A01 CSCL 01C

An unshielded actively cooled structural panel was designed for application to a hypersonic aircraft. The design was an all aluminum stringer-stiffened platefin sandwich structure which used a 60/40 mixture of ethylene glycol/water as the coolant. Eight small test specimens of the basic platefin sandwich concept and three fatigue specimens from critical areas of the panel design was fabricated and tested (at room temperature). A test panel representative of all features of the panel design was fabricated and tested to determine the combined thermal/mechanical performance and structural integrity of the system. The overall findings are that; (1) the stringer-stiffened platefin sandwich actively cooling concept results in a low mass design that is an excellent contender for application to a hypersonic vehicle, and (2) the fabrication processes are state of the art but new or modified facilities are required to support full scale panel fabrication. R.E.S.

N79-31629# Virginia Univ., Charlottesville. Dept. of Mechanical and Aerospace Engineering.

ON THE SOLUTION OF SHELLS OF REVOLUTION WITH CUTOUTS

W. D. Pilkey and I. B. Park Apr. 1979 11 p refs

(Contract N00014-75-C-0374)

(AD-A069997; UVA/525303/MAE79/104) Avail: NTIS HC A02/MF A01 CSCL 12/1

A procedure is outlined for analyzing shells of revolution with nonaxisymmetric geometrical or physical occurrences, e.g. cutouts. Such a cutout means that the shell is no longer a shell of revolution. Advantage is taken of the efficient tools available for analyzing shells of revolution to find the response of a shell which can be modeled as a shell of revolution with such nonaxisymmetric occurrences as cutouts or attachments. In particular, the proposed scheme is a postprocessor for the numerical integration method of shell of revolution analysis. Author (GRA)

N79-31630# Union Coll., Schenectady, N.Y. Inst. of Administration and Management.

A SIMPLE METHOD FOR REGRESSION ANALYSIS WITH CENSORED DATA Technical Report, 1 Jun. 1978 - 15 Apr. 1979

J. Schmee and Gerald J. Hahn 15 Apr. 1979 56 p refs Prepared in cooperation with GE, Schenectady, N. Y.

(Contract N00014-77-C-0436)

(AD-A069816) Avail: NTIS HC A04/MF A01 CSCL 12/1

Problems requiring regression analysis of censored data arise frequently in practice. For example, in accelerated testing one wishes to relate stress and average time to failure from data including unfailed units, i.e., censored observations. Maximum likelihood is one method for obtaining the desired estimates. In this paper, we propose an alternative approach. An initial least squares fit is obtained treating the censored values as failures. Then, based upon this initial fit, the expected failure time for each censored observation is estimated. These estimates are then used, instead of the censoring times, to obtain a revised least squares fit and new expected failure times are estimated for the censored values. These are then used in a further least squares fit. The procedure is iterated until convergence is achieved. This method is simpler to implement and explain to non-statisticians than maximum likelihood and appears to have good statistical and convergence properties. The method is illustrated by an example, and some simulation results are described. Variations and areas for further study also are discussed. GRA

N79-31631# New Jersey Inst. of Technology, Newark.

DYNAMICS OF SUBMERGED CYLINDRICAL SHELLS WITH ECCENTRIC STIFFENING Interim Report

Kerry Kier-Ten Chu, Michael Pappas, and Harry Herman Mar. 1979 62 p refs

(Contract N00014-75-C-0987)

(AD-A069789; NJIT-NV-13) Avail: NTIS HC A04/MF A01 CSCL 20/11

A theoretical analysis is presented for treating the free vibrations of submerged, ring stiffened cylindrical shells with simply supported ends. The effects of the eccentric stiffeners are averaged over the thin-walled isotropic cylindrical shell. The energy method is utilized and the frequency equation is derived by Hamilton's principle. All three degrees of freedom are considered. Numerical results are presented for frequencies for several cases of interest. GRA

N79-31632# Oakland Univ., Rochester, Mich. School of Engineering.

OPTIMIZED INNER BOUNDARY SHAPES IN CIRCULAR RINGS UNDER DIAMETRICAL COMPRESSION

A. J. Durelli and K. Rajaiah Jun. 1979 31 p refs

(Contract N00014-76-C-0487; Grant NSF ENG-77-07974)

(AD-A070000; Rept-52) Avail: NTIS HC A03/MF A01 CSCL 20/11

Using a method developed by the authors, the configuration of the inside boundary of circular rings, subjected to diametral compression, has been optimized, keeping cleared the space enclosed by the original circular inside boundary. The range of diameters studied was 0.33 ID/OD 0.7. In comparison with circular rings of the same ID/OD, the stress concentrations have been reduced by about 30%, the weight has been reduced by about 10% and coefficients of efficiency of about 0.96 have been attained. The maximum values of compressive and tensile stresses on the edge of the hole, and sharp corners exhibit zero stress. The geometries for each ID/OD design are given in detail. Author (GRA)

N79-31633# Chemetal Corp., Pacoima, Calif.

AN INVESTIGATION OF THE CNTD MECHANISM AND ITS

EFFECT ON MICROSTRUCTURAL PROPERTIES Final Technical Report, 17 Mar. 1977 - 15 Dec. 1978
Robert A. Holzl Mar. 1979 65 p refs
(Contract F49620-77-C-0086; AF Proj. 2306)
(AD-A070018; AFOSR-79-0725TR; Rept-4208) Avail: NTIS HC A04/MF A01 CSCL 11/2

The purpose of this research was to investigate the CNTD Controlled Nucleation Thermochemical Deposition process developed at Chemetal as it applies to the microstructural properties of silicon carbide. A general parametric study was conducted of the silicon carbide chemical vapor deposition system with emphasis on parameters which might influence directly the mechanism of CNTD. An iterative approach was employed which related deposition conditions to room temperature tensile strength and microstructure. It was hypothesized that conditions which effected minimum grain size with a probable minimum flaw population in deposits would result in increased strength. CNTD silicon carbide deposits with average grain sizes of 500- A were obtained. Room temperature flexural strengths in excess of 3000 MPa 435 KPSI were recorded on wire samples. Strength was found to be strongly dependent upon microstructure and probably on composition of the deposit. Unexpectedly high fracture toughnesses were observed and were associated with the presence of chlorine during preliminary studies. Widely varying strengths were observed in furnace deposited bend bar samples indicating that the deposition conditions for CNTD SiC on directly heated wire substrates require significant changes when deposition is done in a hot wall furnace. Author (GRA)

N79-31634# Naval Ship Research and Development Center, Bethesda, Md.
PREDICTION OF FATIGUE LIFE BY X-RAY DIFFRACTION METHODS Interim Report
R. N. Pangborn, S. Weissman, and I. R. Kramer May 1979 15 p refs
(ZR0220101)
(AD-A070044; DTNSRDC-79/057) Avail: NTIS HC A02/MF A01 CSCL 11/6

Through the use of a nondestructive X-ray method, the precrack fatigue damage in aluminum 2024-T3 was determined. The method is based on (1) the observation that fatigue fracture is initiated when the excess dislocation density in the surface layer attains a critical value and (2) a knowledge of the excess-dislocation/depth profile for various fractions of fatigue damage. This profile indicates that if the X-ray radiation does not penetrate sufficiently deep into the surface layer, the dislocation density measurements cannot be used as a measurement of fatigue damage. By contrast, the application of penetrating molybdenum radiation, which irradiates grains in the bulk as well as in the surface, gives rise to a linear relationship between the X-ray linewidth and fatigue damage. The slope of this line is sufficiently steep so that, with a knowledge of the critical X-ray linewidth, the fatigue damage can be predicted. The fraction of fatigue damage is given by the ratio beta/beta*, where beta is the linewidth at any number of fatigue cycles and beta* is the critical linewidth at fracture. The critical linewidth may be estimated by using X-ray radiation from chromium and/or by a multiple film technique after the specimen has been cycled approximately 20 percent of its fracture life. Author (GRA)

N79-31635# Analytical and Computational Mathematics, Zurich (Switzerland).
DYNAMICS OF A SYSTEM OF TWO SATELLITES CONNECTED BY A DEPLOYABLE AND EXTENDIBLE TETHER OF FINITE MASS, VOLUME 1
P. Kohler, W. Maag, and R. Wehrli Oct. 1978 297 p refs 2 Vol.
(Contract ESTEC-2992/76-NL-AK(SC))
(ESA-CR(P)-1205-Vol-1) Avail: NTIS HC A13/MF A01

Relative to the study of the dynamics of tethered satellites, an elementary derivation of the equations of motion is presented. Partial differential equations for the three dimensional shape of an extendible tether of variable length and mass were derived from application of Newton's second law and the equation for the rate of change of angular momentum, the two satellites (considered as point masses) yielding boundary conditions. The equations were transformed to variables which are suited for a finite difference approximation. The resulting algorithm, which was implemented in a digital simulation program, including important perturbations, some predetermined deployment laws, and a control law damping oscillations by means of variation of the tether length, is described in detail. Finally, the program description, the user's guide, and a discussion of sample runs are given. Author (ESA)

N79-31636# Eidgenoessische Technische Hochschule, Zurich (Switzerland). Inst. fuer Mechanik.
DYNAMICS OF A SYSTEM OF TWO SATELLITES CONNECTED BY A DEPLOYABLE AND EXTENDIBLE TETHER OF FINITE MASS, VOLUME 2
R. Weber and H. Brauchli Oct. 1978 111 p refs Prepared for Anal. and Computational Math., Zurich 2 Vol.
(Contract ESTEC-2992/76-NL-AK(SC))
(ESA-CR(P)-1205-Vol-2) Avail: NTIS HC A06/MF A01

The mechanical formulation of the full problem of tethered satellites is presented. The system considered consists of two satellites connected by an elastic tether of variable length. Partial differential equations are derived together with the boundary conditions based on two different methods, using first D'Alembert's variational principle for both the motion of the tether and the motion of the satellites resulting from the boundary conditions, and second Hamiston's principle for the whole system, yielding nonholonomic equations in the general cave. The finite element method and Ritz averaging method are given for the numerical approximation. As an appendix some simplified models, namely the spherical pendulum model, longitudinal and transversal oscillations, and a lumped mass model are presented. Applications to spacecraft stabilization are also outlined.
Author (ESA)

42 GEOSCIENCES (GENERAL)

N79-31637# European Space Agency, Paris (France).
EUROPEAN SOUNDING ROCKET, BALLOON AND RELATED RESEARCH, WITH EMPHASIS ON EXPERIMENTS AT HIGH LATITUDES
T. Halvorsen, ed. and B. Battrick, ed. Jun. 1978 544 p refs Presented at ESA/CNES Symp., Ajaccio, Corsica, 24-29 Apr. 1978
(SP-135) Avail: NTIS HC A23/MF A01

Various national rocket and balloon sounding programs are reviewed. Magnetospheric physics, range presentations, middle atmospheric physics, astrophysics, material sciences, subsatellites, and relevant technologies are covered. For individual titles, see N79-31638 through N79-31705.

N79-31638# Graz Univ. (Austria). Dept. of Communications and Wave Propagation.
AUSTRIA'S SOUNDING ROCKET AND SCIENTIFIC BALLOON PROGRAM c46
W. Riedler *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 3-5 Sponsored by Austrian Solar and Space Agency (ASSA) (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

Austrian participation in rocket and balloon campaigns during the past decade is surveyed and results are summarized. Present rocket activities concentrate on particle spectrometry for magnetospheric research and study of the various sources and sinks of energy in the 80 to 130 km region. The balloon research emphasizes the study of magnetospheric dynamics. Future plans are presented, with emphasis on increased international cooperations. Author (ESA)

N79-31639# Centre National d'Etudes Spatiales, Paris (France).
THE FRENCH SOUNDING ROCKET AND BALLOON RESEARCH PROGRAM [PROGRAMME FRANCAIS DE RECHERCHE SPATIALE EN FUSEES-SONDES ET EN BALLONS] c46
J. P. Chassaing *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 11-14 refs In FRENCH (For primary document

see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

The essential characteristics of recent sounding rocket experiments and the balloon program characteristics are reviewed. The French experiments with ionosphere-magnetosphere sounding rockets in aeronomy and meteorology are described. The ground support structure and the scientific programs for open and pressurized balloon research are explained. Author (ESA)

N79-31640# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Bereich fuer Projekttraegerschaften.
THE GERMAN SCIENTIFIC BALLOON AND SOUNDING ROCKET PROJECTS c46
A. F. Dahl *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 15-26 (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

German sounding rocket projects such as experiment preparation for Spacelab (astronomy), aeronomy, magnetosphere, and material science are reviewed as well as scientific balloon projects, used mainly for astronomical research. The survey is completed by tables including future programs up till 1981. The success of this small part of the German space research program is emphasized. Author (ESA)

N79-31641# Royal Norwegian Council for Scientific and Industrial Research, Oslo. Space Activity Div.
THE NORWEGIAN SOUNDING ROCKET PROGRAM, 1978-1981 c46
B. Landmark *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 31-34 (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

The Norwegian sounding rocket program is described including future projects up till 1981. Main projects cover the fields of the effects in the plasma produced by electron guns, aurora pulsations, plasma irregularities in the E and F region, process and dynamics of the mid-atmosphere, effects in the plasma produced by a ground based high power HF transmitter, and ionospheric effects related to the poleward leap. A total of 25 rocket payloads are programmed for the period.
Author (ESA)

N79-31642# Instituto Nacional de Tecnica Aeroespacial, Esteban Terradas, Torrejon de Ardoz (Spain).
THE SPANISH NATIONAL BALLOON AND SOUNDING ROCKET PROGRAM c46
J. Casas and L. Pueyo (Comm. Nacl. de Investigacion del Espacio) *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 35-38 (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

The scientific and technological Spanish programs involving balloons and sounding rockets are reviewed. Main subjects are CONIE/NASA meteorological launchings, ozonospheric program, the cooperative ionospheric sounding rocket project, D-layer research, ionospheric structure at regions near sunrise and sunset, astrophysics and radio astronomy, rocket infrared dayglow measurement, research in ultraviolet astronomy, and cosmic ray research. Author (ESA)

N79-31643# Swedish Space Corp., Solna.
THE SWEDISH SOUNDING ROCKET PROGRAM c46
P. Zetterquist *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 39-41 (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

The Swedish sounding rocket program is described. The investigations relate to ionospheric and magnetospheric phenomena, plasma physics, and the atmosphere's composition at high latitude. Material experiments in zero-g have recently been added to the activities (Swedish experiments were flown on the first TEXUS rocket in December 1977). Plans also exist for launching an IR astronomical experiment on an attitude stabilized sounding rocket in 1980. Technical development in support of the scientific program resulted in a guidance system for reduction of impact dispersion, which enables launchings to very high altitudes and during severe wind conditions. Bilateral and other cooperative projects, in order to economize the sounding rocket activity, and to complement payloads with special experiments are emphasized. Author (ESA)

N79-31644# Appleton Lab., Slough (England).
REVIEW OF THE BRITISH SCIENTIFIC SOUNDING ROCKET AND BALLOON PROGRAMS c46
J. T. Delury *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 45-49 (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

The UK scientific sounding rocket programs which have utilized Skylarks for 21 years, Petrels for 10 years, and Fulmars for 2 years are described. The sounding rocket ongoing program is based on the Petrel and Fulmar rockets, and approved proposals by five UK scientific groups covering 1978 and 1979 are outlined. The British scientific balloon program, which serves 14 scientific groups within UK universities, involves a planned 10 flights per annum using balloons of 3 M cu ft to 31 M cu ft capacity and payloads up to 2 tons in weight. The review outlines the balloon program for flights planned mainly from Palestine, Texas, and Alice Springs/Mildura in Australia. Author (ESA)

N79-31645# Appleton Lab., Slough (England).
PARTICLE ACCELERATION, SPATIAL STRUCTURE, AND PULSATIONS IN THE AURORA c46
D. A. Bryant *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 53-55 refs (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

Three current problems concerning particle precipitation in the aurora are discussed. It is suggested that acceleration may be due to a concentration of energy within a precipitating particle stream. Fine structure in the optical aurora is thought to be a natural consequence of observed electron distributions. A model of auroral pulsations based on a changing geometry of the aurora zone magnetic field lines, appears to be supported by experimental data. Author (ESA)

N79-31646# Mullard Space Science Lab., Dorking (England).
THE SPECTRUM OF AURORAL SUPRATHERMAL ELECTRONS c46
A. D. Johnstone *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 59-61 refs Sponsored by UK Sci. Res. Council (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

The different types of characteristic energy spectra of secondary suprathermal electrons produced by the interaction of a primary electron beam with the ionosphere are described. They include atmospheric secondary electrons, and two types possibly caused by beam plasma interactions. Author (ESA)

N79-31647# Max-Planck-Institut fuer Aeronomie, Katlenburg-Lindau (West Germany).
LOW-ENERGY AURORAL PARTICLE OBSERVATIONS c46
K. Wilhelm *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 63-71 refs (For primary document see N79-31637 22-42)
(Grants DFVLR-BPT-01-D1-123; DFVLR-WRK-274/3; DFVLR-BPT-01-D3-033)
Avail: NTIS HC A23/MF A01

Low-energy auroral electron observations were conducted on several recent sounding rocket flights during various substorm phases. During undisturbed portions of the flight time the electron flux below 500 eV was nearly isotropic and could be described by a power law spectrum. At high energies the spectra were steeper and exhibited a loss cone signature. In disturbed periods nearly mono-energetic electron fluxes in the keV range were often superimposed on these distributions. In addition, strongly field-aligned electrons were frequently observed at low energies. A mechanism for field-aligned electric field acceleration is suggested. Author (ESA)

N79-31648# Centre de Recherches en Physique de l'Environnement Terrestre et Planetaire, Orleans (France).
FRENCH MOBILE STATION FOR RECORDING GEOPHYSICAL DATA: DESCRIPTION; INITIAL RESULTS OF THE CONJUGATED CAMPAIGN IN ASSOCIATION WITH GEOS-1 **c46**
S. Perraut, R. Gendrin, C. deVilledary, D. Fouassier (LGE, France), J. Lavergnat (LGE, France), J. P. Meunier (LGE, France), B. Morlet (LGE, France), F. Langeaud (CEPHAG, France), Y. Corcuff (LPHA, France), M. Tixier (LPHA, France) et al *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 73-84 refs Sponsored in cooperation with Inst. Natl. d'Astron. et de Geophys. and CNRS (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

A mobile station was developed with the main objective of providing a comprehensive set of ground based data in connection with satellite, rocket, or balloon based experiments. The station is equipped with the basic optical and magnetic instruments required for magnetospheric and ionospheric studies, and for the special cases of combined campaigns with geostationary satellites. The station operation is described and some results of comparisons of different detectors within the station are presented in reference to a campaign involving the GEOS-1 satellite at Husafell, Iceland. Author (ESA)

N79-31649# Appleton Lab., Slough (England).
EISCAT **c32**
H. Rishbeth *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 85-94 refs (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

The EISCAT system expected performance, for the UHF component due to become operational in 1979 and the VHF component starting up in 1980, is briefly described. The current status of the EISCAT program, some general theory on incoherent scattering, and physical measurements with EISCAT are reviewed. Some considerations and constraints involved in its use are discussed. Author (ESA)

N79-31650# Max-Planck-Institut fuer Aeronomie, Katlenburg-Lindau (West Germany).
STARE: A NEW POSSIBILITY FOR COORDINATED GROUND-BASED AND ROCKET RESEARCH IN NORTHERN SCANDINAVIA **c46**
R. A. Greenwald *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 95-103 refs (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

The operation of STARE (Scandinavian twin auroral radar experiment) radars is described and actual examples of STARE data from the British high latitude campaign and German substorm phenomena campaign are presented. It is shown that STARE data and rocket sounding measurements are complementary, interacting positively in the interpretation of auroral irregularities and related phenomena. Author (ESA)

N79-31651# Max-Planck-Institut fuer Aeronomie, Katlenburg-Lindau (West Germany).
ROCKET EXPERIMENTS IN CONJUNCTION WITH THE IONOSPHERIC MODIFICATION EXPERIMENT IN NORTHERN NORWAY **c46**
P. Stubbe, H. Kopka, and G. Rose *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 108-111 refs (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

An ionospheric modification experiment will be carried out beginning in 1979 in order to measure the variation of some parameters including electron energy distribution, electrostatic fluctuation spectrum in the electron plasma, and ion acoustic frequency ranges including angular range with respect to the magnetic field. The heating facility and the major modification effects are described. Most effects will be measured by ground based facilities, such as EISCAT incoherent scattering radar, and some will require in situ methods. Complementary rocket experiments will also be carried out. Author (ESA)

N79-31652# Technische Universitaet, Brunswick (West Germany). Inst. fuer Geophysik und Meteorologie.
INITIAL RESULTS OF THE SOUNDING ROCKET CAMPAIGN 'POLAR HIGH ATMOSPHERE' **c46**
B. Theile *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 114-118 refs Sponsored by Bundesmin. fuer Forsch. u. Technol. (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

Measurements to evaluate the ionospheric conductivity tensor were carried out using four sounding rocket payloads in order to contribute to the investigation of the heat input into the polar high atmosphere by a magnetosphere substorm. First results show valuable information on temperature anisotropics, sporadic E-layers, strongly field aligned particle fluxes, and electric field variations. Author (ESA)

N79-31653# Swedish Space Corp., Solna.
THE NIKE-ORION SUCCESSFULLY INTRODUCED AT ESRANGE **c15**
P. Zetterquist *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 119-120 (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

The first launching of the Nike-Orior sounding rocket is described. The Nike-Orion sounding rocket developed by NASA, has an apogee capability of about 130 to 180 km. The first Nike-Orion launching at Esrange took place in April 1977 as part of a US-Swedish cooperative project. After the successful flight, the payload was recovered in undamaged condition. The Swedish Space Corporation has developed a split nose-cone and modular, versatile payload hardware for the Nike-Orion. The standard payload diameter is 14 inches (356 mm) and the typical payload weight ranges from about 70 kg to 150 kg.
Author (ESA)

N79-31654# Uppsala Ionospheric Observatory (Sweden).
PERTURBATIONS ASSOCIATED WITH A PLASMA RELEASE IN THE IONOSPHERE **c46**
G. Holmgren *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 121-122 refs Sponsored by Swed. Board for Space Activities (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

Possible mechanisms for current generation in the ionosphere are discussed and applied to the release experiment. Trigger, in which cesium ions were released by an explosive mixture and the electric field, plasma density, and particle density were measured. It is shown that chemical releases in the ionosphere are capable of locally perturbing the auroral particle flux, and that field aligned currents created by the released ion cloud are the probable cause. In this particular experiment, the expanding cloud mechanism may be a candidate for generation of a field aligned current density exceeding the critical density for current triggered plasma instabilities in the topside ionosphere.
Author (ESA)

N79-31655# Kiruna Geophysical Inst. (Sweden).
SOME CHARACTERISTICS OF THE PARALLEL ELECTRIC FIELD ACCELERATION OF ELECTRONS OVER DISCRETE AURORAL ARCS AS OBSERVED FROM TWO ROCKET FLIGHTS **c46**
R. Lundin and I. Sandahl *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 125-136 (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

Measurements of energetic electrons from two rocket flights, both crossing discrete auroral arc structures, are examined with respect to low altitude parallel potential drops accelerating electrons of magnetospheric origin downward. In both flights the traversals of magnetic field lines connected to discrete auroral arc structures were associated with inverted V like electron spectral features with the highest peak energies closely related to the brightest auroral forms. The most equatorward inverted

V structures, associated with the main arc, seems to mark a boundary south of which the magnetospheric electron population had a higher temperature than north of it. The magnitude and altitude of the potential drop can in principle be obtained by using a model for the acceleration applied to the observed energy and pitch angle distribution of the energetic electrons. A method to study the acceleration mechanism by means of some relations connected to integral flux measurements (energy flux and current density of energetic electrons) is also suggested. Author (ESA)

N79-31656# Swedish Space Corp., Solna.
SOUNDING ROCKET ACTIVITY IN EUROPE IN THE 1980'S **c46**
P. Zetterquist *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 137-147 refs (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

A coordinated European sounding-rocket effort, and its implementation in the next decade is proposed. A survey of present and planned activity in Europe is carried out. The future use of sounding rockets and its relation with the Shuttle and Spacelab is then analyzed. It is concluded that scientific, operational, and economic considerations are in favor of continued sounding-rocket activity in the 1980's and that output would largely benefit from coordination with the ESA Spacelab Utilization Program. The modalities of such a coordinated effort are outlined. Author (ESA)

N79-31657# Swedish Space Corp., Kiruna.
ESRANGE FOR SCIENTIFIC RESEARCH USING SOUNDING ROCKETS AND BALLOONS **c14**
A. Helger *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 151-160 (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

The Esrange facilities and capabilities are described, including the use of high performance rockets such as Aries and Nike-BBVC which make possible the exploration of higher regions with longer observation times. Among the facilities mentioned are Auroral TV, real time GEOS data, VLF receiver, new Faraday frequencies, micropulsation magnetometer, telecommand transmitter, possibility to connect remote scientific measuring equipment to Esrange, a separate balloon TM station, a new wide band TM tape recorder, and a computer program allowing for the tracking of four balloon targets at the same time. An S-band TM back up facility will be operational in the near future. Author (ESA)

N79-31658# Royal Norwegian Council for Scientific and Industrial Research, Oslo. Space Activity Div.
RECENT AND FUTURE ACTIVITY AT ANDOYA ROCKET RANGE **c14**
R. Bjurstroem and A. Gundersen *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 161-166 refs (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

The activities of the Norwegian rocket launching range located at Andoya are described. A total of 160 rocket launchings were made over a 16 year period (up til March 1978), with the participation of several countries that used the range for running their own high latitude, scientific experiments. Existing facilities are reviewed including the ground support system. The launching and data acquisition facilities for scientific high altitude balloons are also described. The structure of the Norwegian space research program and the advantages offered by the Andoya rocket launching range are discussed. Author (ESA)

N79-31659# Instituto Nacional de Tecnica Aeroespacial, Madrid (Spain).
THE 'EL ARENOSILLO' SOUNDING ROCKET RANGE **c14**
J. Casas and M. Vilches *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 167-172 (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

The ground support and launching facilities of the Spanish sounding rocket range of 'El Arenosillo' are described, including communication facilities, launching infrastructures, trajectographic facilities, the telemetry station, and the meteorological station. El Arenosillo range is a partner in the Stratospheric Transmediterranean flights program developing various missions including telemetry recording, balloon tracking, payload separation by telecommand, and payload recovery. Author (ESA)

N79-31660# Campo de Lancamento de Foguetes da Barreira do Inferno, Natal (Brazil).
BARRIERA DO INFERNO: THE BRAZILIAN SOUNDING ROCKET RANGE **c14**
F. J. Hennemann *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Altitudes Jun. 1978 p 173-179 (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

The Brazilian sounding rocket launching range provides the option for scientists to carry out experiments at equatorial latitudes. The facilities of the range are described and a quick survey on present day development status of the Brazilian sounding rocket program is presented. Author (ESA)

N79-31661# Danish Meteorological Inst., Copenhagen.
SOENDRE STROMFJORD ROCKET RANGE **c14**
T. Stockflet Joergensen *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 181-183 (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

The facilities of the rocket launching range at Sondre Stromfjord, Greenland, are described. Information on meteorological conditions, launch restrictions, communications, and current programs are given. Author (ESA)

N79-31662# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
THE MOBILE ROCKET LAUNCHING FACILITY: DEVELOPMENTS AND ACTIVITIES **c14**
R. Klein *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 185-187 (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

The main activities of the Mobile Rocket Launching Base (MORABA) are presented, including some representative examples. The most significant new acquisition, currently nearing completion, is a multipurpose telemetry station, transportable in special containers. The MORABA is also engaged in building up a balloon launching facility, for which purpose some experimental launchings were done. Author (ESA)

N79-31663# Centre National d'Etudes Spatiales, Paris (France).
THE GUYANA SPACE CENTER **c14**
J. J. Cahen *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 189-194 (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

The launching unit and the ground support system of the Guyana space center are described and a brief history of the space center is given. The importance of the near equator location for launchings into synchronous orbits is shown. Author (ESA)

N79-31664# Bern Univ. (Switzerland). Physikalisches Inst.
TRENDS IN MIDDLE ATMOSPHERE RESEARCH **c46**
E. Kopp *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 197-207 refs (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

The present state of knowledge regarding the processes of the upper middle atmosphere above 50 km is reviewed. Special attention is given to some outstanding issues, such as variation of electron density and ion composition of the lower ionosphere, in relation to the problem of excess O3 loss and the need for a study of variations of the composition and transport in the middle atmosphere which has encouraged scientists to participate in a global middle atmospheric research program. It is concluded that a better knowledge of solar radiation below 200 nm and of

NO concentration in the mesosphere are required to obtain better atmospheric models. Author (ESA)

N79-31665# University Coll. of Wales, Aberystwyth.
THE WINTER ANOMALY IN RADIO-WAVE ABSORPTION **c46**

E. R. Williams *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 209-214 refs (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

Progress towards resolving the winter anomaly in radio-wave absorption is reviewed. The anomaly, a local winter effect, is a D-region phenomenon showing strong latitude dependence. In the long term the effect shows a solar cycle variation, but no similar short-term solar control is evident. Three types of winter absorption day are recognized and are reconciled with increased enhancement of D-region electron concentrations. Certainly in the extreme case, and probably in all cases, the enhanced electron concentrations are due to increases in concentration of the minor constituent nitric oxide. Transport from auroral to middle latitudes in winter is inferred and it is suggested that a considerable modification of the D-region chemistry be made at the time. Author (ESA)

N79-31666# Stockholm Univ. (Sweden). Dept. of Meteorology.
SPECTROPHOTOMETRIC MEASURING TECHNIQUES FOR ATMOSPHERIC QUANTAL EMISSIONS **c46**

J. Stegman, P.-E. Tuninger, N. Wilhelm, and G. Witt *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 217-222 refs (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

Different optical measuring techniques and calibration methods are presented. The investigation techniques listed comprise radiometry, polarimetry, and spectroscopic measurements as well as active optical probing from sounding rockets. Author (ESA)

N79-31667# Auroral Observatory, Tromso (Norway).
INTENSITY ENHANCEMENT ON THE WAVELENGTH OF THE HeI 5876 A EMISSION OBSERVED AT HIGH LATITUDE **c46**

K. Henriksen *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 223-234 refs (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

From ground-based spectrometric observation, an emission on the wavelength of HeI 5876 A line is identified during aurora. The emission is slightly Doppler shifted towards the blue side when the direction of observation is above the magnetic horizon. The spectral form of this emission resembles that of an atomic line, not a molecular rotational band. It is likely that this emission is the HeI 5876 A line originating essentially from solar wind alpha-particles. The relative weakness of this emission on the latitude of the polar cleft may be a consequence of the generally low energy of the particle influx in this region. Author (ESA)

N79-31668# Centre d'Etude Spatiale des Rayonnements, Toulouse (France).
HIGH ENERGY ASTROPHYSICS IN EUROPE, USING BALLOONS **c90**

G. Vedrenne *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 237-247 refs (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

The use of balloons in the field of high energy astrophysics is reviewed. Hard X-ray and soft gamma ray astronomy, midrange and high energy gamma ray astronomy, and the study of cosmic radiation are discussed. The scientific objectives include the discovery of sources emitting in these ranges, the study of the large scale variability of the sources by long flights, and the study of the diffuse component, its spectrum and its anisotropy. The most significant results obtained by balloon experiments are listed. Author (ESA)

N79-31669# Max-Planck-Institut fuer Astronomie, Heidelberg (West Germany).
INFRARED OBSERVATIONS WITH THE BALLOON-BORNE TELESCOPE THISBE **c89**

D. Lemke, W. Hofman, and A. Frey *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 249-251 refs (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

Twelve flights were made with the multipurpose astronomical balloon-borne gondola THISBE. The more recent flights were dedicated to infrared observations of objects ranging from the night sky brightness to the zodiacal light and the galactic center. New infrared telescopes are now under development. Author (ESA)

N79-31670# Max-Planck-Institut fuer Astronomie, Heidelberg (West Germany).
ASTRO 7: SIGNIFICANT RESULTS ON ZODIACAL LIGHT AND GALACTIC LIGHT **c89**

E. Pitz, C. Leinert, A. Schulz, and H. Link *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitides Jun. 1978 p 253-256 refs (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

A brief presentation of the basic scientific results of the ASTRO 7 rocket experiment package is given. The surface brightness of the night sky was observed in six broad spectral bands from 180 nm to 900 nm. With emphasis on the ultraviolet, the data were analyzed for the sky brightness constituent zodiacal light, galactic light, and airglow. Color and polarization of the zodiacal light at 30 deg elongation from the ultraviolet to the near infrared is presented. The galactic light is analyzed for its intensity, its dependence on galactic latitude and for its spectrum. Also a contribution to the calibration of the flux of several bright stars is accomplished in the ultraviolet. Author (ESA)

N79-31671# Institut d'Astrophysique, Cointe-Ougree (Belgium). Space Research Group.
PERFORMANCE TESTING OF IMAGE TUBES: ABSOLUTE QUANTUM EFFICIENCY **c74**

M. Henrist *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 257-264 ref (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

The quantum yield of numerous image tubes with broad spectral range was studied. The experimental set-up for the visible region is composed of a calibration lamp and interference filters. In the ultraviolet, a vacuum monochromator is used in combination with a calibrated photomultiplier. The precautions necessary to obtain accurate values of the quantum yield are discussed in detail. The results indicate that good performances are attained by some existing image tubes but large differences are observed between manufacturers and between individual tubes from the same batch. Author (ESA)

N79-31672# Ruhr Univ., Bochum (West Germany). Inst. d'Astronomisches.
THE GALACTIC STRUCTURE IN THE EXTREME ULTRAVIOLET (RESULTS AND FUTURE PROGRAMS) **c90**

W. Schlosser *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 265-266 (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

Wide-angle photographs of our galaxy reveal the fine structure of the arms O, -I and -II. The axis of each spiral arm shows a characteristic pattern b = b(1), which may be used for statistical distance determinations. The mean deviation of spiral tracers from the arm axis decreases with decreasing wavelength and is only 12 per cent at 2900 A. Author (ESA)

N79-31673# Bonn Univ. (West Germany). Inst. fuer Astrophysik.
ASTRO-HEL: A NEW PAYLOAD FOR HIGH RESOLUTION EUV RADIATION ANALYSIS **c90**

H. J. Fahr and G. Lay *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes

Jun. 1979 p 267-275 refs Sponsored by Bundesmin. fuer Forsch. u. Technol. Prepared in cooperation with Tuebingen Univ., West Germany (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

The rocket payload ASTRO-HEL is a helium resonance-cell extreme ultraviolet photometer instrumentation for the high resolution spectral analysis of He-I 58.4 nm and He-II 30.4 nm radiation. The payload is described in detail and the method of data processing is discussed which enables the sure separation of geocoronal and interplanetary radiation components. The concept of the ASTRO-HEL payloads is based on experience obtained from the ASTRO-6 rocket mission. Author (ESA)

N79-31674# Bonn Univ. (West Germany). Inst. fuer Astrophysik.
ASTRO 6: HELIUM RESONANCE RADIATION OBSERVATIONS WITH A BLACK BRANT 4b ROCKET c90
G. Lay, H. J. Fahr, and C. Wulf-Mathies *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 277-281 refs Sponsored by Bundesmin. fuer Forsch. u. Technol. (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

By means of an extreme ultraviolet spectrophotometer using resonance cell techniques the He-I 58.4 nm radiation, resonantly backscattered from geocoronal and interplanetary helium, was measured during a daytime mission in 22 directions on the sky. After separation of the radiation due to geocoronal helium, the remaining intensities were analyzed by comparison with theoretical intensity calculations. A least squares fit yielded the vector of approach of the interstellar helium wind as well as its density outside the solar system. From the geocoronal intensity contribution the temperature as well as the density of the helium geocorona could be deduced. Author (ESA)

N79-31675# Centre National de la Recherche Scientifique, Verrieres-le-Buisson (France). Lab. de Physique Stellaire et Planetaire.
DEVELOPMENT OF A HIGH RESOLUTION ULTRAVIOLET SOLAR SPECTROGRAPH TO BE LAUNCHED ON A BALLOON EQUATORIAL PLATFORM c35
P. Lemaire and D. Samain *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 283-286 refs (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

A telescope-spectrometer instrumentation to study the sun in the spectral ranges 1950-2200 A and 2650-2900 A is being developed to obtain spatial, spectral, and time information on quiet and active fine structures of the solar photosphere-chromosphere zone. To achieve these objectives, an instrumentation able to give 0.5 arcsec angular resolution on the solar surface and 0.01 A spectral resolution was studied.
Author (ESA)

N79-31676# Max-Planck-Institut fuer Extraterrestrische Physik, Garching (West Germany). Inst. fuer Extraterristrische Physik.
LOW ENERGY GAMMA RAY ASTRONOMY AT BALLOON ALTITUDES WITH A COMPTON TELESCOPE c93
F. Graml, F.-P. Penningsfeld, and V. Schoenfelder *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 287-292 refs (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

In October 1977, a large area Compton telescope was flown for the first time on a balloon. It reached an altitude of 3.5 g/cm sq rest atmosphere and stayed there for 20.5 hours. The status of data evaluation from this flight is described. First preliminary results are presented and various astronomical gamma sources are discussed. Two regions show very significant enhanced gamma ray emission: one from 8 to 15 hr universal time in the anticenter of our galaxy, the other occurs during the transit times of NGC 4151, Virgo, and Coma and is observed between 15 and 20 hr universal time. Author (ESA)

N79-31677# Max-Planck-Institut fuer Extraterrestrische Physik, Garching (West Germany).
BALLOON EXPERIMENT FOR THE OBSERVATION OF COSMIC X-RAY SOURCES c35
W. Pietsch, C. Reppin, J. Truemper, W. Voges, E. Kendziorra (Tuebingen Univ.), and R. Staubert (Tuebingen Univ.) *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 293-297 refs (For primary document see N79-31637 22-42)
(Grants DFG-Tr-11/14; DFG-Tr-11/15)
Avail: NTIS HC A23/MF A01

Two phoswich detector systems with 125 cm sq and 800 cm sq geometric areas for use in hard X-ray astronomy were developed and flown on balloons in 1976 and 1977, respectively. The detectors and the orientation system are described and the results on detector background and performance data are presented for five balloon flights. An observation of the binary source AM Her in the energy range from 15 to 100 KeV resulted in an energy spectrum which is in good agreement with measurements from OSO-8 at lower energies assuming an exponential spectrum, but far below the flux observed by ARIEL-5. Author (ESA)

N79-31678# Max-Planck-Institut fuer Extraterrestrische Physik, Garching (West Germany).
BALLOON OBSERVATION OF THE BINARY X-RAY SOURCE HER X-1 1.24 sec PULSATION AND CYCLOTRON LINE EMISSION c93
C. Reppin, W. Pietsch, J. Truemper, W. Voges, E. Kendziorra (Tuebingen Univ.), and R. Staubert (Tuebingen Univ.) *In* ESA European Sounding Rocket, Balloon and Related Res. with Emphasis on Expt. at High Latitudes Jun. 1978 p 299-303 refs (For primary document see N79-31637 22-42)
(Grants DFG-Tr-11/14; DFG-Tr-11/15)
Avail: NTIS HC A23/MF A01

During a balloon observation from Palestine, Texas, the 1.24 sec pulsation of Hercules X - 1 in the hard X-ray range up to 70 keV was detected and strong line emission in its spectrum at 58 keV was discovered. A line flux of 0.003 photons/cm sq/sec and a line width of less than 12 keV was estimated. The phenomenon is thought to be caused by electron cyclotron emission at the basic frequency which is emitted by the hot polar plasma of the rotating neutron star. The line measured leads to a magnetic field strength of 5.3 x 10 to the 12th power Gauss. From further observations during a balloon campaign in 1977 it was confirmed that the line emission exists and that pulsed X-ray emission above 15 keV during the 'Short On' and 'Off'-state of the Her X-1 35 day cycle had been found. The pulse to interpulse ratio seems to vary with the 35 day phase.
Author (ESA)

N79-31679# Bundesministerium fuer Forschung und Technologie, Bonn (West Germany).
MATERIALS SCIENCE REVIEW c15
G. Greger *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Altitudes Jun. 1978 p 307-312 (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

Spacelab utilization for materials research and process engineering is reviewed. Flight opportunities are provided, starting with a preparatory rocket program, followed by the use of a laboratory for materials sciences in the first Spacelab mission and the operation of an advanced technology laboratory in a Spacelab flight within the German space program. An ESA demonstration mission is also discussed. Author (ESA)

N79-31680# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Bereich fuer Projekttraegerschaften.
PROGRAM PLANNING AND PERFORMANCE OF THE SPACELAB UTILIZATION PREPROGRAM TEXUS: TECHNOLOGICAL EXPERIMENTS UNDER ZERO GRAVITY c12
D. Faust *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 313-315 (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

Within the German Spacelab utilization program a preprogram named Texus was started to investigate the low gravity effects achieved during sounding rocket flights of material science experiments. The project Texus 1 was the first complete materials science payload in Europe, launched successfully on Dec. 13,

1977, from Kiruna, Esrange, by a Skylab 7 sounding rocket. It carried five experiment modules into space (four from Germany, one from Sweden), exposing sample material from ten experimenters for about 360 sec to microgravity. The recovered payload of Texus 1 will be refurbished and modified for a Texus 2 mission. Planning for Texus 3 has started. Author (ESA)

N79-31681# Kayser Threde G.m.b.H., Munich (West Germany).
THE CONCEPT OF A MODULAR PAYLOAD WITH DECENTRALIZED INSTRUMENTATION **c15**
A. Schmalz and G. Schmitt *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 317-321 (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

For the Texus micro-gravity program, a modular concept using autonomous payload sections for each experiment was developed. The main feature of this concept is the use of decentralized instrumentation. Each experiment module carries its own power supply, sequencer, and data acquisition system. This concept was used advantageously in the Texus-1 project. Author (ESA)

N79-31682# Royal Inst. of Tech., Stockholm (Sweden).
THE SWEDISH TEXUS EXPERIMENT: A TECHNICAL DESCRIPTION AND SOME PRELIMINARY RESULTS **c12**
T. Carlberg, H. Fredriksson, P. Sunnerkranz, S. Grahn (Swed. Space Corp.), and L. Stenmark (Swed. Space Corp.) *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Altitudes Jun. 1978 p 325-338 refs (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

The Swedish experiment module in the Texus-1 payload was designed to permit pre-Spacelab studies into basic solidification processes approximately. The module contains ten mirror furnaces for solidification of small (1 cu cm) metal samples with a melting point below 1000 C and two gradient furnaces for directional solidification of 8 mm x 100 mm cylindrical samples with a melting point below 1000 C. The detailed design of these furnaces, their performance during the flight and some preliminary scientific results are described. Author (ESA)

N79-31683# Commissariat a l'Energie Atomique, Grenoble (France).
ON THE USE OF SHORT ZERO GRAVITY PERIODS TO STUDY THE SOLIDIFICATION OF Al-In UNMIXABLE ALLOYS [INTERET DE COURTES PERIODES D'IMPESANTEUR POUR L'ETUDE DE LA SOLIDIFICATION DES ALLIAGES IMMISCIBLES Al-In] **c12**
C. Potard *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 339-343 refs In FRENCH (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

An experimental design based on the permanent control of an alloy sample thermal flow is proposed for the study of fluid and solid structures determined by phase transformations under zero gravity conditions. A series of experiments using an Al-In system, to be carried out in cooperation with NASA (STAR program) is described in detail. Author (ESA)

N79-31684# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Inst. for Materials Research.
REARRANGEMENT AND SEPARATION PROCESSES DURING LIQUID PHASE SINTERING UNDER MICROGRAVITY CONDITIONS **c12**
H. U. Walter and G. Ziegler *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 345-352 refs (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

Experiments to investigate rearrangement and separation processes under microgravity conditions were carried out during the coasting phase of a Skylark rocket for a duration of 380 sec in the German Texus program. Five different models systems were investigated, consisting of Ag with additions of Al2O3, W, and glass; pore volumes were on the order of 5% to 35%. Almost complete separation of the components was observed with systems having a contact angle larger than 90 deg (Ag-Al2O3), whereas little separation was found in the case of angles less than 90 deg (Ag-W). The mixture Ag-glass was quantitatively separated. These results indicate that separation can take place under microgravity conditions as well. Preparation of heterogeneous alloys or composites from particle mixtures is, therefore, not possible with mixtures having nonwetting components and pore volume or degassing materials. Author (ESA)

N79-31685# British Aerospace Dynamics Group, Bristol (England).
GENERAL PURPOSE SPACELAB SUBSATELLITE BUS BASED ON SOUNDING ROCKET TECHNOLOGY **c16**
D. M. Ashford *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 357-364 refs (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

A small low cost modular subsatellite bus for use with Spacelab is described. It is based on sounding rocket technology and the baseline version consists of a Skylark body section, an encoder, timer, transmitter, and battery pack. It offers the following facilities for experiments: an experiment volume of 25 cudm, an experiment mass of 24 kg, an experiment power of 16 W, an experiment data rate of 16 kb its /sec at 16 km, and an operating life of 5 hours. Various optional uprating modules are described which improve these facilities and provide additional services. Author (ESA)

N79-31686# Kayser Threde G.m.b.H., Munich (West Germany).
ADAPTATION OF SOUNDING ROCKET TECHNOLOGY TO SPACELAB SUBSATELLITES **c15**
R. Klett and A. Schmalz *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 365-374 refs Sponsored by ESA (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

A study on the adaptation of sounding rocket technology to Spacelab subsatellites was conducted. The objective of the study was to design a low cost, general purpose subsatellite of modular construction which could be adapted to various missions. The subsatellites are ejected from Spacelab and can be used to support measurement work done in conjunction with Spacelab. The target cost is discussed for the basic subsatellite. As an alternative, these subsatellites could also be flown as small self-contained payloads under the NASA Get-Away Special program. Author (ESA)

N79-31687# Consiglio Nazionale delle Ricerche, Rome (Italy). Servizio Attivita Spaziali.
TRANSATLANTIC FLIGHTS OF STRATOSPHERIC BALLOONS [LES VOLS TRANSATLANTIQUES DES BALLONS STRATOSPHERIQUES] **c02**
G. P. Cecchini and M. Malavasi *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 377-381 In FRENCH; ENGLISH summary (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

The use of high altitude balloons as Spacelab complementary low cost research tools is discussed. The economic factors are reviewed and the payload capacity is analyzed, showing that a weight of 1500 kg at a height equivalent to 1.5 millibar is typical of Spacelab conditions. The Milo launching facility (Italy) is described. It is concluded that balloon flights are well suited for pretesting Spacelab payloads. Author (ESA)

N79-31688# Centre National d'Etudes Spatiales, Toulouse (France).
FIRST EXPERIMENTAL TRANSMEDITERRANEAN BALLOON FLIGHT **c02**
M. Malavasi (Consiglio Nazl. delle Ric.), J. Medina (Grupos Cien. de la CONIE), J. Sequeiros (Grupos Cien. de la CONIE), and A. Soubrier *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 383-386 (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

The characteristics of the first stratospheric large volume (330,000 m3) balloon flight launched from Sicily and recovered in southern Spain after 22 hours 20 minutes are presented. The payload consisted of technical equipment and a passive cosmic ray detector whose characteristics are also presented.
Author (ESA)

N79-31689# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
CONCEPT AND FIRST EXPERIENCES WITH THE DFVLR MOBILE BALLOON BASE c02
G. Reimann and H. D. Schlichter *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 387-391 (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

Technical aspects and campaign requirements which resulted in the formulation of a mobile balloon launch concept are discussed. First results of balloon launchings performed with the method are presented. A summary of planned activities is also given.
Author (ESA)

N79-31690# Centre National d'Etudes Spatiales, Toulouse (France). Div. Mathematiques et Traitement.
OMEGA POINT CALCULATOR [CALCULATEUR DE POINTS OMEGA] c04
J. L. Pieplu, R. Rumeau, and M. Vincent *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 393-395 In FRENCH (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

The characteristics of an economic ground system that was developed for processing Omega signals retransmitted from a balloon in order to determine its location are described. Microprocessors were utilized adopting simple models for wave propagation correction and for the point estimation algorithms. An experimental test is being carried out.
Author (ESA)

N79-31691# Centre National d'Etudes Spatiales, Toulouse (France).
PREVISIONS AND EXPERIMENTAL RESULTS IN OPEN BALLOON CONTROLLED DESCENT [PREVISION ET DEPOUILLEMENTS DE VOLS DE BALLONS OUVERTS EN DESCENTE PILOTE] c02
M. Romero, M. Rougeron, and C. Tockert *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 397-402 refs In FRENCH (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

Balloon flight remote control by means of a pole located relief valve and ballast reduction is discussed. A computerized simulation was performed and four balloon flights were executed in 1977. Results show that the proposed flight control method permits a controlled descent or a leveling-off in a simple manner.
Author (ESA)

N79-31692# Geneva Observatory (Switzerland).
ASTRONOMICAL NACELLE STABILIZED BY MEANS OF AN ULTRAVIOLET DETECTOR WITH A PHOTOMULTIPLIER [NACELLE ASTRONOMIQUE STABILISEE AVEC DETECTEUR UV A GALETTE DE MICROCANAUX] c89
D. Hugenin and A. Magnan (Lab. d'Astron. Spatiale) *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 403-406 In FRENCH (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

A polyvalent nacelle developed during an international cooperation program is described. The structural characteristics, primary stabilization are discussed. The Schmidt Cassegrain anastigmatic flat field (SCAP) ultraviolet optical system is analyzed in detail. A description of current scientific programs includes research on weak blue stars, ultraviolet spectrometry of galaxy centers, and detection of H2 galactic regions at 1900 A.
Author (ESA)

N79-31693# Bristol Aerojet, Ltd., Banwell (England).
SMALL ROCKETS FOR EXPERIMENTS AT HIGH LEVELS c15
W. T. Fisher *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 407-409 (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

The aerodynamic drag and structural heating of rockets for research are discussed in the context of the requirements for conductive surfaces and avoidance of outgassing. Drag curves are presented which are basically applicable to any rocket with any number of stages. Economic advantages in the use of small rockets are emphasized and illustrated by examples. Efficiency curves for sounding rockets as a function of stage size distribution are given. Available motors for multistage rockets are reviewed.
Author (ESA)

N79-31694# British Aerospace Dynamics Group, Bristol (England).
RECENT ADVANCES IN SKYLARK VEHICLE TECHNOLOGY c15
D. J. Brown *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 411-416 refs (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

The increased performance of sounding rockets, following the introduction of the Raven 11 motor in 1975, is reviewed. The apogee range available varies from 150 km for Skylark 5 to 1000 km for Skylark 12. Skylark 14 can provide over 8 minutes useful flight under microgravity conditions. The Raven 11/Snipe combination can attain an altitude of over 650 km with a small payload (260 mm in diameter, 70 kg mass).
Author (ESA)

N79-31695# Max-Planck-Institut fuer Extraterrestrische Physik, Garching (West Germany).
X-RAY EXPERIMENT ASTRO-8 c89
H. Hippmann and U. Zimmermann *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 419-422 refs (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

The development of instruments for low energy X-ray astronomy is described. The first experiment performance, Astro 8, is mentioned in detail. The preliminary results are given and the future program is presented. The experiment is designed to look for X-ray sources in the energy range from 0.2 to 2 keV and analyze the flux for spectral lines and time variation. Curves showing the spectral energy flux of the Vela SNR and the Crab SNR with its central pulsars are presented. The upper limits found for the pulsed flux in the X-ray region from Vela are below the extrapolated valves of the radio and gamma flux.
Author (ESA)

N79-31696# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. for Flight Systems Dynamics.
FAST PRE-LAUNCH TARGETING AND COMPUTATIONS FOR CONTROLLED SOUNDING ROCKETS c15
A. E. Pietrass and L. H. Larsson (Swed. Space Corp.) *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 423-430 refs (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

Recent high performance sounding rockets were equipped with control systems so as to reduce impact dispersions. This gain can only be fully realized if deterministic wind and gyro error effects are taken into account in the pre-launch targeting calculations. A perturbation method is developed to facilitate fast pre-launch trajectory simulation, including the autopilot functions, on a medium-size process computer. The program also computes the wind-predicted instantaneous impact point trace for range-safety application. The method was implmented at Esrange for the rockets Aries and Black-Brant Vc with a Saab S19B guidance system. Operational applications are discussed.
Author (ESA)

N79-31697# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
EVALUATION OF TELEMETRY DATA FOR POST-FLIGHT

ATTITUDE DETERMINATION OF SOUNDING ROCKETS c17

J. Stangl (Industrieanlagen Betriebsgesellschaft), R. Thiemann (Industrieanlagen Betriebsgesellschaft), and N. Jansen *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 431-436 refs (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

To calculate the attitude and other data of sounding rockets, computer programs for evaluating telemetry data were developed and successfully applied to the German ASTRO-7, Winteranomalie, Polare Hochatmosphare, and ARIES projects. First, the current measurement-time is allocated to the pitch, yaw, and roll telemetry data coming from an inertial platform and, occasionally, a three-axial magnetometer. Then, these data are scaled to physical values and smoothed via selectable time periods and selectable-degree polynomes. Possible measuring or telemetry errors can be eliminated by setting suitable bounds. The smoothed values are provided in settable time intervals for calculating attitude and additional data, and processed in line with the experimenter specifications. Some of the problems likely to arise from this data processing are briefly discussed. Author (ESA)

N79-31698# Swedish Space Corp., Solna.
THE S19 GUIDANCE SYSTEM FOR REDUCTION OF SOUNDING ROCKET DISPERSION c15

L. Anderson, S. Lundin, and J. Andersson (Saab-Scania AB) *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 437-440 refs (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

The S19 guidance system used to significantly reduce the impact dispersion of sounding rockets is described. With the guidance system, the main contributions to impact dispersion caused by wind errors and thrust misalignment are reduced by a factor of up to ten depending on the comparative unguided case. Therefore, the guidance system will make it possible to launch sounding rockets to much higher altitudes at restricted ranges and will reduce the stand-by time due to severe wind conditions. The modular concept has the advantage that the guidance system, with mirror changes, can be mounted on several different one- or two-stage rockets without any modification of the rocket. Another benefit is that the modular concept permits re-use, since the guidance system can be recovered with the payload. Author (ESA)

N79-31699# Saab-Scania, Linkoping (Sweden).
SOME SUBSYSTEMS OF PAYLOAD S29 c15

J. Andersson and T. Forsell *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 441-447 (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

The S29 sounding rocket is described. A launch from Esrange is planned for March or April 1979. The payload has a total weight of 193 kg and will be launched to an apogee altitude of 405 km with a Nike-Black Brant VC rocket. Some technically interesting subsystems are described including: a split nose cone, radially and forward deployable booms, which are cheap and simple, yet permit repeated testing, a yoyo device to introduce deliberate coning automatically released at the desired roll angle using magnetometer signals, and a mechanism for forward separation on ground command, of a Barium shaped charge.
Author (ESA)

N79-31700# Space Vector Corp., Northridge, Calif.
SOUNDING ROCKET ATTITUDE CONTROL UTILIZING TUNED ROTOR GYROS c15

R. O. Rasmussen, S. D. Lyon, and J. H. Jerger *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 449-456 ref (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

A precision Attitude Control System (ACS) for the orientation and scanning of celestial and terrestrial targets with infrared instruments is described. Tuned rotor gyros were selected as the precision inertial references for the ACS. Tuned rotor gyros and their supporting electronics are extensively discussed. The complete mechanization of the ACS is described. Aspects of the digital programmer, digital integration, and important software considerations are highlighted. Author (ESA)

N79-31701# Observatoire de Paris-Meudon (France).
SPACE RESEARCH WITH AIRBORNE PLATFORMS c05

P. Lena and D. Rouan *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 461-465 refs (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

Existing high performance aircraft are briefly listed with some comments on the basic capabilities needed to carred out programs in space observation, astronomy and other disciplines. Special attention is given to infrared astronomy where airborne platforms allow the observation of a large domain of radiation inaccessible from the ground. In this respect an infrared airborne astronomy program carried out in Europe is described; the telescope is a 32 cm Cassegrain flown with numerous associated focal plane instruments on a Caravelle, but also on the NASA CV.990. A few missions are described, involving European institutes, and some results are discussed. Several airborne multidisciplinary missions have been carred out for Spacelab simulations (ASSESS). Author (ESA)

N79-31702# Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany).
PERFORMANCE OF APPARATUS AND EQUIPMENT IN TEXUS 1 c35

J. E. Geisel and B. J. Franke *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 467-474 (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

A general description of the module and performance data from the experiment sections is presented. Texus-1 is highly modulatized in both its mechanical and electrical equipment while also being highly redundant. Its use provided information for the design of Spacelab payloads. Functional performance during flight did not show relevant failures; results with halogen lamps, microgravity quality, and furnace temperature are discussed.
Author (ESA)

N79-31703# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
THE SPACE PROCESSING MISSION OF TEXUS 1 WITH RESPECT TO A MICRO-G ENVIRONMENT AND RECOVERY c12

K. Schmidt, G. Schneiders, G. E. Todd, and G. Schmitt (Kayser Threde GMBH) *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 475-481 refs (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

The Texus-1 mission with respect to the zero-g phase and re-entry is described. Registration of the zero-g environment involved the use of micro-g sensors and rate gyros. Calibration of the sensors, the measurements derived during the flight, and the methods of data processing, including data filtering, are discussed. The obtained results are compared with those of the NASA SPAR program. Successful recovery of the payload was a mandatory feature of the Texus-1 mission. The theoretical work concerning the simulation of the re-entry phase, e.g. tumbling motion and drag deceleration are compared with the actual performance. Author (ESA)

N79-31704# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
AN ATTITUDE SENSING TECHNIQUE FOR SOUNDING ROCKETS, USING RF-INTERFEROMETRY c15

G. Mayer and G. E. Todd *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 483-486 refs (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

A simple attitude sensing system which was primarily designed for use on earth survey rockets, but is also of use for the attitude stabilization of all types of space vehicles is presented.

The system uses an airborne radio direction finder or interferometer to control the payload in the propagation direction of the incident wave from UHF transmitter beacons located at the points of interest in an earth resources survey. Author (ESA)

N79-31705# Centre d'Etude Spatiale des Rayonnements, Toulouse (France).
AURORAL INVESTIGATIONS BY BALLOON-BORNE OBSERVATORIES DURING THE SAMBO 1 CAMPAIGN
c46
J. P. Treilhou, F. Cambou, I. A. Zhulin, and L. Lazutin *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 487-496 refs Prepared in cooperation with Acad. of Sci. (USSR), Moscow and Swed. Space Corp., Solna (For primary document see N79-31637 22-42)
(Contract CNES-73-150-212)
Avail: NTIS HC A23/MF A01

A French-Soviet experiment using multiple balloons and multiple telemetry stations in auroral zones is described. The simultaneous auroral multi-balloon observatories (SAMBO) experiment was performed during the period January through March, 1974 to study X-ray precipitation, photometric emissions, and electric fields at many points in the sky during auroral disturbances. Results show the presence of a growth phase clearly visible in the X-ray and riometer records and that a space-energy ambiguity exists in the X-ray measurements due to some very localized intensifications of electron precipitation which produces the same X-ray energy spectrum as a wide precipitation region where the electron energy spectrum becomes harder.
Author (ESA)

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.
For instrumentation see *35 Instrumentation and Photography*.

N79-31706* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
COAL-ROCK INTERFACE DETECTOR
Stephen D. Rose, Charles E. Crouch, and Elborn W. Jones, inventors (to NASA) (Mississippi State Univ., Mississippi State) 21 Aug. 1979 8 p Filed 4 Nov. 1977
(NASA-Case-MFS-23725-1; US-Patent-4,165,460; US-Patent-Appl-SN-848793; US-Patent-Class-250-253; US-Patent-Class-250-272) Avail: US Patent and Trademark Office CSCL 08I

A coal-rock interface detector is presented which employs a radioactive source and radiation sensor. The source and sensor are separately and independently suspended and positioned against a mine surface of hydraulic pistons, which are biased from an air cushioned source of pressurized hydraulic fluid.
Official Gazette of the U.S. Patent and Trademark Office

N79-31707*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
UTILIZATION OF THE LANDSAT IMAGES ON THE STUDY OF THE IMPACT OF VICINITY HIGHWAYS [APLICACAO DAS IMAGENS DO LANDSAT AO ESTUDO DE IMPACTOS DE RODOVIAS VICINAIS]
Nelson deJesusParada, Principal Investigator, Madalena Niero, and Luiz Fernando R. H. Rodrigues Mar. 1979 25 p refs In PORTUGUESE; ENGLISH summary Sponsored by NASA ERTS
(E79-10239; NASA-CR-158803; INPE-1441-NTE/147) Avail: NTIS HC A02/MF A01 CSCL 08B

There are no author-identified significant results in this report.

N79-31708*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
GEOLOGICAL MAP OF PARTS OF THE STATE OF SAO PAULO BASED ON LANDSAT IMAGES [MAPA GEOLOGICO DE PARTE DO ESTADO DE SAO PAULO BASEADO EN IMAGENS LANDSAT]
Nelson deJususParada, Principal Investigator, Gilberto Amaral, Chan Chiang Liu, and Raimundo Almeida Filho Mar. 1979 33 p refs In PORTUGUESE; ENGLISH summary Sponsored by NASA ERTS
(E79-10240; NASA-CR-158804; INPE-1437-RPE/012) Avail: NTIS HC A03/MF A01 CSCL 08B

The author has identified the following significant results. Interpretation of LANDSAT images revealed the subdivision of the Bauru formation into three distinct lithofacies. Delineation of structural features yielded new information on paleoenvironmental reconstitution and hydrogeology. Structural features and photogeological units were revealed in the precambrian basement at the eastern portion of the state.

N79-31709*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
USE OF THE AUTOMATIC CLASSIFICATION OF LANDSAT DATA ON THE DEFINITION OF AREAS OF PRIMARY ILMENITE IN FLORESTA, PERNAMBUCO
Nelson deJesusParada, Principal Investigator, Sylvio deQueiros-Mattos, Waldir Renato Paradella, and Paulo Roberto Menezes Jan. 1979 25 p refs In PORTUGUESE Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS (E79-10249; NASA-CR-158857; INPE-1415-RPE/003) Avail: NTIS HC A02/MF A01 CSCL 02F

There are no author-identified significant results in this report.

N79-31710*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). COMPOSITION AND ASSEMBLY OF A SPECTRAL-MET DATA BASE FOR SPRING AND WINTER WHEAT, VOLUME 1
M. H. Trenchard, Principal Investigator, M. L. Sestak, M. C. Kinsler, and D. E. Phinney May 1979 26 p Sponsored by NASA, NOAA, and USDA EREP
(Contract NAS9-15800)
(E79-10250; NASA-CR-160283; JSC-14901-Vol-1; LEC-13393-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N79-31711*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). RESEARCH PLAN FOR DEVELOPING AND EVALUATING CLASSIFIERS
C. B. Chittineni, Principal Investigator Jul. 1979 20 p refs Sponsored by NASA, NOAA, and USDA EREP
(Contract NAS9-15800)
(E79-10251; NASA-CR-160285; LACIE-00633; JSC-14849; LEC-13300) Avail: NTIS HC A02/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N79-31712*# Stanford Univ., Calif. Dept. of Geology.
HCMM: SOIL MOISTURE IN RELATION TO GEOLOGIC STRUCTURE AND LITHOLOGY, NORTHERN CALIFORNIA
Ernest I. Rich, Principal Investigator 21 Jul. 1979 3 p refs ERTS
(Contract NAS5-24479)
(E79-10252; NASA-CR-158858) Avail: NTIS HC A02/MF A01 CSCL 08M

The author has identified the following significant results. First-look qualitative geologic evaluation of day- and night-IR images discloses several en echelon linear features extending throughout the central part of the northern coast range in California, across the Mendocino triple junction and into southern Oregon. Preliminary examination of these features with respect to topographic expression, vegetation, sun angle and azimuth, and atmospheric conditions suggests that they may be related to the intracontinental plate boundary (Lake Mountain Fault zone of Herd) of the Humbolt Plate. The linear features, which cut across several climatic zones and differently vegetated regions are not confined to topographic valleys, but cross the ridges

and valleys at varying angles. Lithology within the Great Valley Sequence can be detected on a few of the images; however, preliminary evaluation suggests that the thermal banding observed may be a function of sun azimuth or late-day sun angle. Soil moisture, related to lithologic composition cannot be ruled out at this time.

N79-31713*# South Dakota State Univ., Brookings. Remote Sensing Inst.
HCMM ENERGY BUDGET DATA AS A MODEL INPUT FOR ASSESSING REGIONS OF HIGH POTENTIAL GROUND WATER POLLUTION Interim Report, Apr. - Jun. 1979
Donald G. Moore, Principal Investigator and J. Heilman Jun. 1979 3 p ERTS
(Contract NAS5-24206)
(E79-10253; NASA-CR-158859; SDSU-RSI-79-13) Avail: NTIS HC A02/MF A01 CSCL 08H
There are no author-identified significant results in this report.

N79-31714*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
FISHING CHARTS: A MODEL OF FISHING CHARTS UTILIZING OCEANOGRAPHIC DATA AND REMOTE SENSORS; AS APPLIED TO SARDINES, SARDINELLA BRASILIENSIS [CARTAS DE PESCA: UM MODELO DE CARTAS DE PESCA UTILIZANDO DADOS OCEANOGRAFICOS E DE SENSORIAMENTO REMOTO, APLICADO A SARDINHA, SARDINELLA BRASILIENSIS]
Nelson deJesusParada, Principal Investigator and Sydnea Maluf Feb. 1979 234 p refs In PORTUGUESE; ENGLISH summary Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(E79-10254; NASA-CR-158860; INPE-1423-TDL/03) Avail: NTIS HC A11/MF A01 CSCL 08A
There are no author-identified significant results in this report.

N79-31715*# Cornell Univ., Ithaca, N. Y.
CORNELL UNIVERSITY REMOTE SENSING PROGRAM Semiannual Status Report, 1 Dec. 1978 - 31 May 1979
Ta Liang, Arthur J. McNair, and Warren R. Philipson, Principal Investigators Jun. 1979 221 p refs ERTS
(Grant NGL-33-010-171)
(E79-10255; NASA-CR-158861) Avail: NTIS HC A10/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N79-31716*# Geological Survey, Denver, Colo.
ALTERED ROCK SPECTRA IN THE VISIBLE AND NEAR INFRARED
Graham R. Hunt and Roger P. Ashley, Principal Investigators [1979] 57 p refs Sponsored by NASA ERTS
(E79-10256; NASA-CR-158862) Avail: NTIS HC A04/MF A01 CSCL 08G
The author has identified the following significant results. Visible and near-infrared (0.35 to 2.5 micron m) bidirectional reflection spectra recorded for a suite of well-characterized hydrothermally altered rock samples typically display well defined bands caused by both electronic and vibrational processes in the individual mineral constituents. Electronic transitions in the iron-bearing constituent minerals produce diagnostic minima near 0.43, 0.65, 0.85, and 0.93 micron m. Vibrational transitions in clay and water-bearing mineral constituents produce characteristic single or multiple features over limited spectral ranges near 1.4, 1.75, 1.9, 2.2, and 2.35 micron m. The most abundant feature-producing minerals present in these rocks are hematite, goethite, and alunite. Others frequently present are jarosite, kaolinite, potassium micas, pyrophyllite, montmorillonite, diaspore, and gypsum. The spectral region near 2.2 micron m is particularly important for detecting altered rocks by remote sensing.

N79-31717*# Geological Survey, Reston, Va.
EVALUATION OF LANDSAT MULTISPECTRAL SCANNER IMAGES FOR MAPPING ALTERED ROCKS IN THE EAST TINTIC MOUNTAINS, UTAH
Lawrence C. Rowan and Michael J. Abrams, Principal Investigators (JPL) [1979] 136 p refs Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(E79-10257; NASA-CR-158863; Rept-78-736) Avail: NTIS HC A07/MF A01 CSCL 08G
The author has identified the following significant results. Positive findings of earlier evaluations of the color-ratio compositing technique for mapping limonitic altered rocks in south-central Nevada are confirmed, but important limitations in the approach used are pointed out. These limitations arise from environmental, geologic, and image processing factors. The greater vegetation density in the East Tintic Mountains required several modifications in procedures to improve the overall mapping accuracy of the CRC approach. Large format ratio images provide better internal registration of the diazo films and avoid the problems associated with magnifications required in the original procedure. Use of the Linoscan 204 color recognition scanner permits accurate consistent extraction of the green pixels representing limonitic bedrock maps that can be used for mapping at large scales as well as for small scale reconnaissance.

N79-31718*# Geological Survey, Reston, Va.
DISCRIMINATION OF HYDROTHERMALLY ALTERED ROCKS ALONG THE BATTLE MOUNTAIN-EUREKA, NEVADA MINERAL BELT USING LANDSAT IMAGES
M. Dennis Krohn, Michael J. Abrams (JPL), and Lawrence C. Rowan, Principal Investigators [1979] 92 p refs Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(E79-10258; NASA-CR-158864) Avail: NTIS HC A05/MF A01 CSCL 08G
The author has identified the following significant results. Limonitic alteration halos associated with two copper prophyry deposits were successfully mapped at Battle Mountain. Alteration halos from both a hypogene system at Copper Canyon and a supergene system at Copper Basin are recognizable in the composite. Both copper porphyry deposits are located in sedimentary rock units that commonly have ferruginous coatings; yet, in most cases, the hydrothermally derived limonite was distinguishable in the CRC from sedimentary limonite. Large format playback images with pixel sizes from 200 to 400 micron m provided details of spatial resolution and color separation unachievable on enlargements from 70 mm film chips. Details of the alteration halos could be resolved only in the large format images. Two aspects of the alteration halos of the porphyry copper deposits were not mapped on the CRC. The optimum CRC image for the area studied consists of MSS 4/5 as blue, MSS 4/6 as yellow, and MSS 6/7 as magenta using diazo films. The disseminated gold deposits at Gold Acres are not depicted in the CRC image.

N79-31719*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
FOREST RESOURCE INFORMATION SYSTEM. PHASE 2: DEMONSTRATION REPORT Quarterly Report, 1 Jan. - 30 Apr. 1979
R. P. Mroczyski, Principal Investigator 30 Apr. 1979 139 p refs EREP
(Contract NAS9-15325)
(E79-10259; NASA-CR-160275; LARS-043079) Avail: NTIS HC A07/MF A01 CSCL 02F
There are no author-identified significant results in this report.

N79-31720*# ECON, Inc., Princeton, N. J.
STATUS OF SEASAT COMMERCIAL DEMONSTRATION PROGRAM
Larrain Luckl and B. P. Miller, Principal Investigators Dec. 1978 86 p refs Workshop held at Pasadena, Calif., 31 Oct. - 1 Nov. 1978 Sponsored by NASA ERTS
(E79-10260; NASA-CR-158875; ECON-78-292) Avail: NTIS HC A05/MF A01 CSCL 17B
There are no author-identified significant results in this report.

N79-31721*# ECON, Inc., Princeton, N. J.
THE ECONOMIC COSTS AND BENEFITS OF AN INTERNA-

TIONAL GRAIN RESERVE PROGRAM WITH AND WITHOUT IMPROVED (LANDSAT) CROP INFORMATION: A CASE STUDY BASED ON THE ECON INTEGRATED MODEL Final Report
31 Dec. 1978 63 p refs ERTS
(Contract NASw-3047)
(E79-10261; NASA-CR-158876; ECON-77-294-1) Avail: NTIS HC A04/MF A01 CSCL 17B
There are no author-identified significant results in this report.

N79-31722*# ECON, Inc., Princeton, N. J.
THE ECONOMIC COSTS AND BENEFITS OF AN INTERNATIONAL GRAIN RESERVE PROGRAM WITH AND WITHOUT IMPROVED (LANDSAT) CROP INFORMATION: A CASE STUDY BASED ON THE ECON INTEGRATED MODEL SUMMARY AND OVERVIEW Final Report
31 Dec. 1978 25 p refs ERTS
(Contract NASw-3047)
(E79-10262; NASA-CR-158877; ECON-77-294-2) Avail: NTIS HC A02/MF A01 CSCL 17B
There are no author-identified significant results in this report.

N79-31723*# Battelle Columbus Labs., Ohio.
REVIEW OF PRICING POLICY ALTERNATIVES FOR THE OPERATIONAL LANDSAT SYSTEM Final Report
R. W. Earhart, Principal Investigator, J. A. Madigan, W. F. Moore, and R. F. Porter Nov. 1977 97 p refs ERTS
(Contract NASw-2800)
(E79-10263; NASA-CR-158878; BCL-OA-TFR-77-6) Avail: NTIS HC A05/MF A01 CSCL 12A
There are no author-identified significant results in this report.

N79-31724*# Pakistan Water and Power Development Authority, Lahore.
WATER RESOURCES INVESTIGATION IN PAKISTAN WITH THE HELP OF ERTS IMAGERY, SNOW SURVEYS, 1975-1976
Asrar Ahmad Qureshy and Mohammed Umar, Principal Investigators Mar. 1978 92 p Sponsored by NASA ERTS
(E79-10265; NASA-CR-157455) Avail: NTIS HC A05/MF A01 CSCL 08H
There are no author-indentified significant results in this report.

N79-31725*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
COLORIMETRIC PRINCIPLES AS APPLIED TO MULTICHANNEL IMAGERY M.S. Thesis - Houston Univ. at Clear Lake City
Richard D. Juday, Principal Investigator Jul. 1979 68 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 EREP
(E79-10266; NASA-TM-58215; JSC-14873) Avail: NTIS HC A04/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N79-31726*# Dartmouth Coll., Hanover, N.H.
AN INVESTIGATION OF VEGETATION AND OTHER EARTH RESOURCE/FEATURE PARAMETERS USING LANDSAT AND OTHER REMOTE SENSING DATA. A: LANDSAT. B: REMOTE SENSING OF VOLCANIC EMISSIONS Semiannual Status Report, 1 Jan. - 30 Jun. 1979
Richard W. Birnie and Richard E. Stoiber, Principal Investigators 30 Jun. 1979 28 p refs ERTS
(Grant NsG-5014)
(E79-10267; NASA-CR-157428; SASR-10) Avail: NTIS HC A03/MF A01
There are no author-identified significant results in this report.

N79-31727*# Metrics, Inc., Atlanta, Ga.
DESIGN OF A LOW-COST AUTOMATED LANDSAT DATA ANALYSIS SYSTEM Final Report
G. William Spann, Nancy J. Hooper, and Nickolas L. Faust, Principal Investigators Jul. 1979 47 p refs ERTS
(Contract NAS8-33136)
(E79-10268; NASA-CR-161285) Avail: NTIS HC A03/MF A01 CSCL 05B
There are no author-identified signficant results in this report.

N79-31728*# Texas A&M Univ., College Station. Remote Sensing Center.
MEASUREMENT OF SOIL MOISTURE TRENDS WITH AIRBORNE SCATTEROMETERS Progress Report, 1 Jun. 1978 - 1 Jun. 1979
Bruce J. Blanchard, Principal Investigator 1 Jun. 1979 15 p ERTS
(Grant NsG-5134)
(E79-10270; NASA-CR-162092; RSC-3458-3) Avail: NTIS HC A02/MF A01 CSCL 08M
There are no author-identified significant results in this report.

N79-31729*# Department of Agriculture, Phoenix, Ariz. Water Conservation Lab.
HCMM HEAT CAPACITY MAPPING MISSION Quarterly Progress Report, 1 May - 31 Jul. 1979
Ray D. Jackson, Principal Investigator 31 Jul. 1979 1 p ERTS
(NASA Order S-40255-B)
(E79-10272; NASA-CR-162101) Avail: NTIS HC A02/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N79-31730*# Stanford Univ., Calif. School of Applied Earth Sciences.
GEOLOGICAL AND GEOTHERMAL DATA USE INVESTIGATIONS FOR APPLICATION EXPLORER MISSION-A, HEAT CAPACITY MAPPING MISSION Quarterly Report, 1 Nov. 1978 - 28 Feb. 1979
R. J. P. Lyon and A. E. Prelat, Principal Investigators 28 Feb. 1979 2 p ERTS
(Contract NAS5-24232)
(E79-10273; NASA-CR-162094) Avail: NTIS HC A02/MF A01 CSCL 08B
There are no author-identified significant results in this report.

N79-31731*# Stanford Univ., Calif. School of Applied Earth Sciences.
GEOLOGICAL AND GEOTHERMAL DATA USE INVESTIGATIONS FOR APPLICATION EXPLORER MISSION-A, HEAT CAPACITY MAPPING MISSION Quarterly Report, 1 Mar. - 30 Jun. 1979
R. J. P. Lyon and J. C. Broderick, Principal Investigators 30 Jun. 1979 2 p ERTS
(Contract NAS5-24232)
(E79-10274; NASA-CR-162095) Avail: NTIS HC A02/MF A01 CSCL 08B
There are no author-identified significant results in this report.

N79-31732*# Bern Univ. (Switzerland). Dept. of Geography.
TOPOCLIMATOLOGICAL AND SNOWHYDROLOGICAL SURVEY OF SWITZERLAND Progress Report
Matthias Winiger, Principal Investigator Aug. 1979 5 p Sponsored by NASA ERTS
(E79-10275; NASA-CR-162096; PR-1) Avail: NTIS HC A02/MF A01 CSCL 08L
The author has identified the following significant results. The chosen time of overflight of HCMM seems to be ideal for the study of basic climatological events. Nocturnal temperature inversion zones are easily detectable and their dependency on the relief is clearly seen. Especially the alpine valleys show a very differentiated pattern of cold lakes, separated by warmer zones as a consequence of rock and forrest barriers or changes in the valley profile. Wet areas are usually colder than dry parts under comparable topographic conditions. Even very small topographic obstacles are able to block up the flow of cold air

masses (or ground water flow). Urban areas are clearly detectable. Differences to the surface temperatures of surrounding rural land are much more significant during day-time (mainly during the summer months). Fog layers are clearly defined in the visible channel (day-time), but much more difficult to identify in the IR (mainly during the night). There is not a fundamental difference to NOAA-analysis of cloud systems. The most important advantage is the better detectability of convective cloud systems (small cumulus clouds).

N79-31733*# Consiglio Nazionale delle Ricerche, Milan (Italy).
HEAT CAPACITY MAPPING MISSION (HCMM) PROGRAM Progress Report
Roberto Cassinis, Giovanni Maria Lechi, Principal Investigators, Pietro Alessandro Brivio, Alberto Marini, Renzo Moretti, and Eugenio Zilioli 25 Aug. 1979 20 p Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(E79-10276; NASA-CR-162097; PR-1) Avail: NTIS HC A02/MF A01 CSCL 08G

There are no author-identified significant results in this report.

N79-31734*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
GEOLOGIC APPLICATION OF THERMAL INERTIA IMAGING USING HCMM DATA Quarterly Report, Apr. - Jun. 1979
Helen N. Paley and Anne B. Kahle, Principal Investigators Aug. 1979 4 p ERTS
(Contract NAS7-100)
(E79-10277; NASA-CR-162099) Avail: NTIS HC A02/MF A01 CSCL 08G

There are no author-identified significant results in this report.

N79-31735*# Texas A&M Univ., College Station. Remote Sensing Center.
DRYLAND PASTURE AND CROP CONDITIONS AS SEEN BY HCMM Quarterly Progress Report, Apr. - Jul. 1979
Wesley D. Rosenthal and James C. Harlan, Principal Investigators 30 Jul. 1979 1 p ERTS
(Contract NAS5-24383)
(E79-10278; NASA-CR-162100) Avail: NTIS HC A02/MF A01 CSCL 02C

There are no author-identified significiant results in this report.

N79-31736*# National Aeronautics and Space Administration, Washington, D. C.
REMOTE SENSING
Armando Jinich Aug. 1979 25 p refs Transl. into ENGLISH from Ciencia y Desarrollo (Mexico), no. 26, May/Jun. 1979 p 33-41, 45 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75651) Avail: NTIS HC A02/MF A01 CSCL 05B

Various imaging techniques are outlined for use in mapping, land use, and land management in Mexico. Among the techniques discussed are pattern recognition and photographic processing. The utilization of information from remote sensing devices on satellites are studied. Multispectral band scanners are examined and software, hardware, and other program requirements are surveyed. A.W.H.

N79-31737*# ECON, Inc., Princeton, N. J.
SEASAT-A ASVT: COMMERCIAL DEMONSTRATION EXPERIMENTS. RESULTS ANALYSIS METHODOLOGY FOR THE SEASAT-A CASE STUDIES
28 Aug. 1979 62 p refs Revised
(Contract NASw-3047)
(NASA-CR-162162; DOC-79-292-2-Rev-2) Avail: NTIS HC A04/MF A01 CSCL 05B

The SEASAT-A commercial demonstration program ASVT is described. The program consists of a set of experiments involving the evaluation of a real time data distributions system, the SEASAT-A user data distribution system, that provides the capability for near real time dissemination of ocean conditions and weather data products from the U.S. Navy Fleet Numerical Weather Central to a selected set of commercial and industrial users and case studies, performed by commercial and industrial users, using the data gathered by SEASAT-A during its operational life. The impact of the SEASAT-A data on business operations is evaluated by the commercial and industrial users. The approach followed in the performance of the case studies, and the methodology used in the analysis and integration of the case study results to estimate the actual and potential economic benefits of improved ocean condition and weather forecast data are described. A.W.H.

N79-31738*# EG and G Washington Analytical Services Center, Riverdale, Md.
UTILIZATION OF SATELLITE-SATELLITE TRACKING DATA FOR DETERMINATION OF THE GEOCENTRIC GRAVITATIONAL CONSTANT (GM) Final Report
C. F. Martin and I. H. Oh Aug. 1979 28 p refs
(Contract NAS6-2495)
(NASA-CR-156856) Avail: NTIS HC A03/MF A01 CSCL 08B

Range rate tracking of GEOS 3 through the ATS 6 satellite was used, along with ground tracking of GEOS 3, to estimate the geocentric gravitational constant (GM). Using mulitple half day arcs, a GM of 398600.52 + or - 0.12 cu km/sq sec was estimated using the GEM 10 gravity model, based on a speed of light of 299792.458 km/sec. Tracking station coordinates were simultaneously adjusted, leaving geopotential model error as the dominant error source. Baselines between the adjusted NASA laser sites show better than 15 cm agreement with multiple short arc GEOS 3 solutions. K.L.

N79-31739# Army Research Inst. for the Behavioral and Social Sciences, Alexandria, Va.
AN APPROACH TO ASSESSMENT OF RELIEF FORMATS FOR HARDCOPY TOPOGRAPHIC MAPS
Lawrence M. Potash, John P. Farrell, and Thomas E. Jeffrey Apr. 1979 33 p refs
(DA Proj. 2Q1-62717-A-721)
(AD-A069462; ARI-TP-356) Avail: NTIS HC A03/MF A01 CSCL 08/2

The relief assessment test described in this report is designed to assess the effect of supplementing contour lines with other relief formats. It contains eight types of problems and a review of relevant aspects of map reading. It has been produced in three relief formats: contour lines, contour lines plus layer tints, and contour lines plus shading. Initial work indicates that addition of layer tints to contour lines can increase speed of reading some types of relief information; whereas, addition of shaded relief does not increase map reading speed more than use of layer tints and can cause a decrease in accuracy. Map designers will be interested in this report. GRA

N79-31740# Naval Postgraduate School, Monterey, Calif.
THE USE OF TEMPERATURE AND COLOR IN SATELLITE DETECTION OF OCEAN FRONTS AND EDDIES FOR ASW APPLICATIONS. A SUMMARY OF SELECTED LITERATURE CONDENSED AND EDITED Technical Report, Jul. - Sep. 1978
Eugene D. Traganza Feb. 1979 60 p refs
(AD-A069955; NPS-68-79-008) Avail: NTIS HC A04/MF A01 CSCL 15/1

The purpose of this report is to briefly update the state of the art of detection of ocean fronts and eddies by satellite sensed sea surface temperature and to consider oceanographic color characteristics which may be used to detect their presence when the sea surface temperature pattern is absent.
Author (GRA)

N79-31741# Sandia Labs., Albuquerque, N. Mex.
TRUE IN SITU PROCESSING OF OIL SHALE: AN EVALUATION OF CURRENT BED PREPARATION TECHNOLOGY
R. R. Boade, A. L. Stevens, A. Long, and A. E. Harak Mar. 1979 88 p refs
(Contract EY-76-C-04-0789)
(SAND-78-2162) Avail: NTIS HC A05/MF A01

It is concluded that the wellbore springing and hydraulic/explosives fracturing concepts both have inherent traits which

prohibit their practical application to deep oil shale seams. Difficulties with the wellbore springing concept stem largely from the cylindrical geometry which leads to rapidly attenuating stress waves (hence to comparatively small fractured regions) and to the creation of a residually stressed region around the explosive cavity that restricts fluid flow and hinders void redistribution efforts. Major problems with the hydraulic/explosive fracturing concept are that many operations cannot be controlled and that regions of enhanced permeability are formed only in the vicinity of explosive filled hydrofractures. The physical characteristics of a successful bed preparation concept are defined along with recommendations for a research oriented program to develop the technology necessary to achieve a successful true in situ retorting capability. DOE

N79-31742# Illinois State Geological Survey, Urbana.
GEOLOGIC AND GEOCHEMICAL STUDIES OF THE NEW ALBANY GROUP (DEVONIAN BLACK SHALE) IN ILLINOIS TO EVALUATE ITS CHARACTERISTICS AS A SOURCE OF HYDROCARBONS Quarterly Progress Report, 1 Apr. - 30 Jun. 1978
Robert E. Bergstrom and Neil F. Shimp 1978 51 p
(Contract EY-76-C-05-5203)
(ORO-5203-9; QPR-3) Avail: NTIS HC A04/MF A01

A detailed analysis of the lithology, stratigraphy, and structure of the New Albany Group in Illinois was performed to determine those characteristics of lithology, thickness, regional distribution, vertical and lateral variability, and deformation that are most relevant to the occurrence of hydrocarbons. DOE

N79-31743# Oak Ridge National Lab., Tenn. Chemical Technology Div.
ENGINEERING ANALYSIS AND COMPARISON OF NEW PROCESSES FOR THE RECOVERY OF RESOURCE MATERIALS FROM COAL ASH
R. M. Canon, F. G. Seeley, and J. S. Watson 1979 18 p refs Presented at the 5th Intern. Ash Util. Symp., Atlanta, 25-27 Feb. 1979
(Contract W-7405-eng-26)
(CONF-790205-3) Avail: NTIS HC A02/MF A01

During the past 2 years, several promising new processes for the recovery of valuable resource materials from coal ash, primarily power plant fly ash, were conceived and investigated. These processes, which include direct acid leach, the salt-soda sinter process, and the Calsinter (CaSo4-CaCO3) process, are designed to remove the major metals (aluminum, iron, and titanium) from fly ash; however, some are also capable of recovering trace metals. DOE

N79-31744# Sandia Labs., Albuquerque, N. Mex.
USE OF ELECTRICAL GEOPHYSICAL TECHNIQUES TO MAP AND MONITOR IN SITU OIL SHALE RECOVERY PROCESSES
L. C. Bartel 1979 25 p refs Presented at 12th Oil Shale Symp., Golden, Colo., 18 Apr. 1979
(Contract EY-76-C-04-0789)
(SAND-79-0746C; Conf-790440-2) Avail: NTIS HC A02/MF A01

The electrical conducting property of the in situ coal gasification and oil shale retort reaction zones forms the basis for using electrical geophysical prospecting techniques to map and monitor these in situ processes. The electrical geophysical techniques include: mise-a-la-masse, Schlumberger, and a borehole electrical survey. The field measurements are supported by extensive model calculation and data reduction efforts. The in situ coal gasification reaction boundaries were successfully delineated using the mise-a-la-masse technique and a ridge regression data inversion algorithm. DOE

N79-31745# Los Alamos Scientific Lab., N. Mex.
ROCKY MOUNTAIN COAL FOR SOUTHERN CALIFORNIA'S COAL-FIRED ELECTRIC POWER GENERATION
O. L. Anderson Feb. 1979 144 p refs
(Contract W-7405-eng-36)
(LA-6915-MS) Avail: NTIS HC A07/MF A01

A scaled-down version of a Study of Alternative Locations of Coal-Fired Electrical Generating Plants to Supply Western Coal to the Department of Water Resources is reported. It covers three aspects of the major report: (1) coal resources in the Upper Colorado Plateau, (2) the possible transportation of those coal resources to southern California, and (3) the cost analyses of the coal transportation. Descriptions of 92 coalfields within an 800 mile radius of the Los Angeles energy market are included. The general legal regulations governing the acquisition and development of coal from state, federal, and private lands are discussed. The existing and potential methods of transporting the coal to southern California are also described. DOE

N79-31746# Dow Chemical Co., Midland, Mich. Hydrocarbons and Energy Research Dept.
ENERGY FROM IN SITU PROCESSING OF ANTRIM OIL SHALE
J. P. Humphrey 19 Jul. 1979 44 p refs
(Contract EX-76-C-01-2346)
(FE-2346-29) Avail: NTIS HC A03/MF A01

In situ combustion was maintained for a 61 day period while several continuous and cyclic production procedures were tested. Gas having energy values in the target range (150 Btu scf) was produced at various times, although the flow rate at these times was minimal and hence the energy production was low. A hydraulic fracturing and sand propping program was completed in 100 Series wells. Preparations for explosive fracturing are essentially complete. The plans for the first explosive shot in the explosive underreaming experiment were completed and final preparations are underway. Shale characterization and resource inventory activities are continuing in four of the major universities of Michigan. DOE

N79-31747# Thomson-CSF, Meudon-la-Foret (France). Dept. Espace-Satellites.
STUDY OF SAR FOR THE EUROPEAN REMOTE SENSING PROGRAM: EXECUTIVE SUMMARY Final Report
11 Dec. 1978 114 p refs Prepared in cooperation with Dornier-Werje G.m.b.H., Friedrichshafen and Selenia S.p.A., Rome Original contains color illustrations
(Contract ESA-3523/78-F-CG(SC))
(ESA-CR(P)-1174) Avail: NTIS HC A06/MF A01

A detailed analysis of system specification, spacecraft interfaces, the influence of system geometry, image quality requirements, and processing tasks is presented followed by a trade-off study leading to the choice of orbit altitude, look angle, pulse duration, pulse repetition frequency, antenna dimensions, radar resolution, RF power, onboard/onground interface, and downlink modulation technique. The main critera directing the trade-off study were the reduction of the RF power and the compatibility with present platform design. A baseline configuration scheme is given, showing a resulting 310 W average RF power or an orbit altitude of 822 km. Author (ESA)

N79-31748# Eurosat S.A., Geneva (Switzerland).
STUDY ON THE IDENTIFICATION OF SERVICES AND ORGANIZATIONS INTERESTED IN THE USE OF THE SPACELAB METRIC CAMERA Final Report
C. L. P. Miller 15 Dec. 1978 89 p
(Contract ESA-3537/78-F-HC(SC))
(CLP/PR/3278; ESA-CR(P)-1184) Avail: NTIS HC A05/MF A01

Nine countries in Africa were visited and 40 organizations contacted. Results show that there is a great interest in the use of the Spacelab metric camera. The main cartographic interest involves the revision of existing maps, particularly on the 1:200,000 and 1:250,000 scale and the making of new topographic maps primarily scaled at 1:50,000 which presently exist for only about 18 percent of Africa. For thematic applications the camera technical characteristics are appreciated. Certain limitations in the performance of the camera, and the capability of various African organizations to use the product are discussed. Author (ESA)

N79-31749# Environmental Data Service, Washington, D. C.
ENVIRONMENTAL SATELLITE IMAGERY, MARCH 1978
Apr. 1978 53 p refs
(PB-296057/3; KMRD-5.4-7803; NOAA-S/T-79-89) Avail: NTIS HC A04/MF A01 CSCL 04B

The hemispheric mosaics derived from Scanning Radiometer data, and prepared daily by high speed computer are described.

Visible and infrared data swaths obtained while the satellite is southbound on the daylight side of the orbit are used in the 09L mosaics; infrared data swaths obtained during northbound passage are used in the 21L mosaics. The scanline signals are digitized, earth located, and repositioned on a standard polar stereographic map projection. Coastal outlines and latitude/lingitude lines at 10 degree intervals are added by the computer. Overlap between successive swaths is eliminated, with the latest data retained. GRA

N79-31750# Texas Dept. of Water Resources, Austin.
OCCURRENCE, QUANTITY AND QUALITY OF GROUND WATER IN TAYLOR COUNTY, TEXAS
Howard D. Taylor Oct. 1978 159 p refs
(PB-295064/0; TDWR/R-224) Avail: NTIS HC A08/MF A01 CSCL 13B

The occurrence, quantity, and quality of the ground water resources of the county were studied. Emphasis was on determining the sources of water suitable for domestic, livestock, public supply, industrial, and irrigational uses. Areas and possible sources of present or potential ground water contamination were determined. Significant amounts of fresh to moderately saline ground water occur in aquifers of the Permian, Cretaceous, and Quaternary Systems. The principal aquifers are the Choza Formation, the San Angelo Formation, and the alluvium of Quaternary age. GRA

N79-31751# Washington State Univ., Pullman. Computer Service Center.
A CASE STUDY OF THE OPERATIONAL ASPECTS OF THE NATURAL RESOURCE INFORMATION SYSTEM (NRIS) USED FOR NATURAL RESOURCE PLANNING
Doris Steingraber Jul. 1978 165 p refs Prepared in cooperation with Colville Confederated Tribes, Nespelem, Wash.
(Contract DI-14-20-0500-4883)
(PB-295923/7) Avail: NTIS HC A08/MF A01 CSCL 08B

The computer support activities performed in natural resources planning for the Colville Indian Reservation located in the central part of the State of Washington are described. The natural resource information system (NRIS) was the computer overlay mapping system selected for use. The objectives of the case study and the actual execution of the case study are described, and the operational aspects of using NRIS in a production environment are discussed and evaluated. An attribute assignment process developed is also described. GRA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N79-31752* National Aeronautics and Space Administration. Pasadena Office, Calif.
SOLAR CELL WITH IMPROVED N-REGION CONTACT AND METHOD OF FORMING THE SAME Patent
Kenneth R. Bube, inventor (to NASA) (RCA Labs.) Issued 7 Aug. 1979 3 p Filed 30 Jun. 1978 Supersedes N78-27541 (16 - 18 p 2410 Sponsored by NASA
(NASA-Case-NPO-14205-1; US-Patent-4,163,678; US-Patent-Appl-SN-920879; US-Patent-Class-136-89CC; US-Patent-Class-29-572; US-Patent-Class-29-589; US-Patent-Class-357-30; US-Patent-Class-357-65; US-Patent-Class-357-67; US-Patent-Class-252-514; US-Patent-Class-106-1; US-Patent-Class-106-1.2; US-Patent-Class-427-88) Avail: US Patent and Trademark Office CSCL 10A

An improved solar cell, and method of forming the same are disclosed. It is characterized by a semiconductor silicon wafer of P-type material having diffused therein a shallow N-type region. A sintered silver contact is affixed to the surface of the N-type region at the outer surface. The improved solar cell is formulated from silver powder blended with silver metaphosphate for establishing a zone of increased carrier concentration. An aluminum or silver-aluminum alloy contact is affixed to the P-type wafer at the outer surface opposite the N-type region.

Official Gazette of the U.S. Patent and Trademark Office

N79-31753* National Aeronautics and Space Administration. Pasadena Office, Calif.
SOLAR CELL MODULE Patent
Neal F. Shepard, Jr., inventor (to NASA) (GE Co., Philadelphia) Issued 31 Jul. 1979 4 p Filed 29 Sep. 1978 Supersedes N79-10529 (17 - 01 p 0070) Sponsored by NASA
(NASA-Case-NPO-14467-1; US-Patent-4,162,928; US-Patent-Appl-SN-946994; US-Patent-Class-136-89PC) Avail: US Patent and Trademark Office CSCL 10A

An improved solar cell module for use in terrestrial environments is disclosed. It is characterized by: (1) an internally reflective plate having a planar surface of incidence and an opposed textured surface (2) a plurality of uniformly spaced silicon solar cells having the active surfaces thereof bonded to portions of the textured surface, and (3) a layer of diffusely reflective matter applied to the textured surface in surrounding relation with the solar cells for reflecting solar energy. The solar energy then strikes the surface of incidence at such angles as to be internally re-reflected and caused to progress toward the active surfaces of the solar cells, whereby concentration of incident flux on the solar cell is achieved without increased module depth.

Official Gazette of the U.S. Patent and Trademark Office

N79-31754*# Tylan Corp., Torrance, Calif.
VITRE-GRAF COATING ON MULLITE. LOW COST SILICON ARRAY PROJECT: LARGE AREA SILLICON SHEET TASK Final Report, 14 Dec. 1977 - 13 Jun. 1979
Ronald C. Rossi Jun. 1979 81 p refs Prepared for JPL and DOE
(Contract JPL-954896)
(NASA-CR-162269; DOE/JPL-954896-79/1) Avail: NTIS HC A05/MF A01 CSCL 10A

The processing parameters of the Vitre-Graf coating for optimal performance and economy when applied to mullite and graphite as substrates were presented. A minor effort was also performed on slip-cast fused silica substractes. M.M.M.

N79-31755*# California Univ., Los Angeles.
SILICON SOLAR CELL FABRICATION TECHNOLOGY Quarterly Report, 1 Jan. - 30 Apr. 1979
O. M. Stafsudd 2 May 1979 34 p ref Sponsored in part by DOE Prepared for JPL
(Contract JPL-954902)
(NASA-CR-162166; DOE/JPL-954902-79/4; QR-4) Avail: NTIS HC A03/MF A01 CSCL 10A

The laser cell scanner was used to characterize a number of solar cells made in various materials. An electron beam-induced current (EBIC) study was performed using a stereoscan scanning electron microscope. Planar p-n junctions were analyzed. A theory for the EBIC based on the analytical solution of the ambipolar diffusion equation under the influence of electron beam excitation parameter z (which is related to beam penetration), the junction depth Z sub j, the beam current and the surface recombination, was formulated and tested. The effect of a grain boundary was studied. G.Y.

N79-31756*# Battelle Columbus Labs., Ohio.
EVALUATION OF SELECTED CHEMICAL PROCESSES FOR PRODUCTION OF LOW-COST SILICON, PHASE 3 Quarterly Progress Report, 1 Apr. - 30 Jun. 1979
J. M. Blocher, Jr. and M. F. Browning 15 Aug. 1979 18 p ref Sponsored in part by DOE Prepared for JPL
(Contracts NAS7-100; JPL-954339)
(NASA-CR-162168; DOE/JPL-954339-79/15; QPR-15) Avail: NTIS HC A02/MF A01 CSCL 10A

The construction and operation of an experimental process system development unit (EPSDU) for the production of granular semiconductor grade silicon by the zinc vapor reduction of silicon tetrachloride in a fluidized bed of seed particles is presented.

The construction of the process development unit (PDU) is reported. The PDU consists of four critical units of the EPSDU: the fluidized bed reactor, the reactor by product condenser, the zinc vaporizer, and the electrolytic cell. An experimental wetted wall condenser and its operation are described. Procedures are established for safe handling of SiCl4 leaks and spills from the EPSDU and PDU. A.W.H.

N79-31757*# Optical Coating Lab., Inc., City of Industry, Calif. Photoelectronics Div.
DEVELOPMENT OF LOW COST CONTACTS TO SILICON SOLAR CELLS Semiannual Report, 15 Oct. 1978 - 31 May 1979
P. A. Iles and D. P. Tanner 31 May 1979 74 p refs Sponsored by NASA Prepared for DOE and JPL
(Contract JPL-955244)
(NASA-CR-162179; DOE/JPL-955244-79/2) Avail: NTIS HC A04/MF A01 CSCL 10A

Different electroless plating systems were evaluated in conjunction with copper electroplating. All tests involved simultaneous deposition of front and back contacts using a standard cell materials. Cells with good adhesion and good curve fill factors were obtained using a palladium-chromium-copper metallization system. The final copper contact system was evaluated to determine if the copper would migrate at elevated temperatures. The copper migrated at elevated temperatures causing cell output degradation. A.W.H.

N79-31758*# RCA Labs., Princeton, N. J.
EPITAXIAL SILICON GROWTH FOR SOLAR CELLS Final Report
R. V. DAiello, P. H. Robinson, and D. Richman Apr. 1979 66 p refs Prepared for DOE and JPL
(Contracts NAS7-100; JPL-954817)
(NASA-CR-162177; DOE/JPL-954817-79/4) Avail: NTIS HC A04/MF A01 CSCL 10A

The epitaxial procedures, solar cell fabrication, and evaluation techniques are described. The development of baseline epitaxial solar cell structures grown on high quality conventional silicon substrates is discussed. Diagnostic layers and solar cells grown on four potentially low cost silicon substrates are considered. The crystallographic properties of such layers and the performance of epitaxially grown solar cells fabricated on these materials are described. An advanced epitaxial reactor, the rotary disc, is described along with the results of growing solar cell structures of the baseline type on low cost substrates. The add on cost for the epitaxial process is assessed and the economic advantages of the epitaxial process as they relate to silicon substrate selection are examined. A.W.H.

N79-31759*# RCA Labs., Princeton, N. J.
AUTOMATED ARRAY ASSEMBLY, PHASE 2 Quarterly Report
R. V. DAiello Jun. 1979 36 p refs Prepared for DOE and JPL
(Contracts NAS7-100; JPL-954868)
(NASA-CR-162176; DOE/JPL-954868-79/7; QR-6) Avail: NTIS HC A03/MF A01 CSCL 10A

The large scale production of silicon solar cell array panels is discussed. The cost and performance of three manufacturing sequences designed to convert silicon sheet and wafers into solar panels is analyzed. The production of ion implanted and furnace annealed solar cells made using solar grade n- and p-type wafers is examined. The performance of production size lots is examined with regard to the relationship between the ion implant and furnace anneal parameters and the ability to form consistently good thick film screen printed contacts. The spray on antireflection coating process is evaluated. The performance of several lots of cells before and after coating is measured. The structure and refractive index of the RCA I (TiO2) coating is compared with commercial solutions. Sensitivity of coated, screen printed cells to the post heat treatment required to cure the films is assessed. A.W.H.

N79-31760*# Siltec Corp., Menlo Park, Calif.
LSA LARGE AREA SILICON SHEET TASK. CONTINUOUS LIQUID FEED CZOCHRALSKI GROWTH Quarterly Report, Apr. - Jun. 1979
George Fiegl Jul. 1979 22 p Sponsored by NASA Prepared for DOE and JPL
(Contract JPL-954886)
(NASA-CR-162178; DOE/JPL-954886-79/3; QR-7) Avail: NTIS HC A02/MF A01 CSCL 10A

The design and development of equipment and processes to demonstrate continuous growth of crystals by the Czochralski method suitable for producing single silicon crystals for use in solar cells is presented. The growth of at least 150 kg of mono silicon crystal, 150 mm in diameter is continuous from one growth container. A furnace with continuous liquid replenishment of the growth crucible, accomplished by a meltdown system with a continuous solid silicon feed mechanism and a liquid transfer system, with associated automatic feedback controls is discussed. Due to the silicon monoxide build up in the furnace and its retarding effect on crystal growth the furnace conversion for operation in the low pressure range is described. Development of systems for continuous solid recharging of the meltdown chamber for various forms of poly silicon is described. A.W.H.

N79-31761*# SOL/LOS, Inc., Los Angeles, Calif.
A NEW METHOD OF METALLIZATION FOR SILICON SOLAR CELLS Quarterly Report, 1 Apr. - 30 Jun. 1979
Milo Macha 30 Jun. 1979 27 p Sponsored by NASA and DOE Prepared for JPL
(Contract JPL-955318)
(NASA-CR-162164; DOE/JPL-955318-79; QR-2) Avail: NTIS HC A03/MF A01 CSCL 10A

The determination of the firing cycle in a horizontal tube furnace for MoO3: Sn ink composition applied by silk screening process on P or N structured solar cells is presented. In comparison with the strip heater used to determine the reaction mechanism, the reduction of MoO3 in the tube furnace progresses at a much faster rate and the Sn:Mo alloy forms at a much lower temperature. The device characteristics determined by the V-I curve showed a high resistance (approx. 10 Ohms) at peak temperatures between 600 C and 800 C. The high series resistance is attributed to the lack of formation of MoSi2 within the used temperature range. A.W.H.

N79-31762*# Westinghouse Research and Development Center, Pittsburgh, Pa.
SILICON WEB PROCESS DEVELOPMENT Quarterly Report, 20 Apr. - 30 Jun. 1979
C. S. Duncan, R. G. Seidensticker, R. H. Hopkins, J. P. McHugh, F. E. Hill, M. E. Heimlich, and J. M. Driggers 30 Jun. 1979 55 p refs Sponsored by NASA Prepared for DOE and JPL (Contract JPL-954654)
(NASA-CR-162181; DOE/JPL-954654-79/3) Avail: NTIS HC A04/MF A01 CSCL 10A

Silicon dendritic web, ribbon form of silicon and capable of fabrication into solar cells with greater than 15% AMI conversion efficiency, was produced from the melt without die shaping. Improvements were made both in the width of the web ribbons grown and in the techniques to replenish the liquid silicon as it is transformed to web. Through means of improved thermal shielding stress was reduced sufficiently so that web crystals nearly 4.5 cm wide were grown. The development of two subsystems, a silicon feeder and a melt level sensor, necessary to achieve an operational melt replenishment system, is described. A gas flow management technique is discussed and a laser reflection method to sense and control the melt level as silicon is replenished is examined. A.W.H.

N79-31763*# TRW Systems Group, Redondo Beach, Calif. Manufacturing Div.
STUDY OF AUTOMATED MODULE FABRICATION FOR LIGHTWEIGHT SOLAR BLANKET UTILIZATION Final Report
Charles E. Gibson May 1979 79 p refs Prepared for JPL
(Contracts NAS7-100; JPL-955205)
(NASA-CR-162157; TRW-79.5536.3-06) Avail: NTIS HC A05/MF A01 CSCL 10A

Cost-effective automated techniques for accomplishing the titled purpose; based on existing in-house capability are described. As a measure of the considered automation, the production of a 50 kilowatt solar array blanket, exclusive of support and deployment structure, within an eight-month fabrication period

was used. Solar cells considered for this blanket were 2 x 4 x .02 cm wrap-around cells, 2 x 2 x .005 cm and 3 x 3 x .005 cm standard bar contact thin cells, all welded contacts. Existing fabrication processes are described, the rationale for each process is discussed, and the capability for further automation is discussed. G.Y.

N79-31764*# Chicago Univ., Ill. Enrico Fermi Inst.
WINSTON SOLAR CONCENTRATORS AND EVALUATION SUPPORT. PHASE 2: NON-IMAGING CONCENTRATORS FOR SPACE APPLICATIONS Final Report, Oct. 1977 - Jul. 1978
Roland Winston, Joseph OGallagher, and Peretz Greenman 28 Aug. 1978 81 p refs Prepared for JPL
(Contract JPL-954563)
(NASA-CR-162279) Avail: NTIS HC A05/MF A01 CSCL 10A

A 4.67X, plus or minus 5 deg. compound parabolic concentrator (CPC) for a large photovoltaic array in space was analyzed. The design was demonstrated to be effective in achieving a net power gain which can be varied from more than a factor of 3 down to approximately unity. A method for reducing nonuniformities in illumination to a given desired level was found. The effectiveness of this method, which involves the introduction of a degree of non-specularity in the reflector surface, was confirmed by direct measurements with prepared foil reflectors in a CPC in terrestrial sunshine as well as by computer ray tracing. Further ray tracing confirms that the CPC design is extremely tolerant to pointing and alignment errors, minor distortions, etc. A two stage non-imaging design was shown, by preliminary measurements and analysis, to provide both the desired angular tolerance and the required degree of intensity uniformity if higher concentrations (4X-10X) are necessary. Author

N79-31765*# Solarex Corp., Rockville, Md.
HIGH EFFICIENCY, HIGH DENSITY TERRESTRIAL PANEL Final Report
John Wohlgemuth, Manfred Wihl, and Thomas Rosenfield Feb. 1979 70 p Sponsored in part by DOE Prepared for JPL
(Contract JPL-954822)
(NASA-CR-162167; DOE/JPL-954822-78/1) Avail: NTIS HC A04/MF A01 CSCL 10A

Terrestrial panels were fabricated using rectangular cells. Packing densities in excess of 90% with panel conversion efficiencies greater than 13% were obtained. Higher density panels can be produced on a cost competitive basis with the standard salami panels. K.L.

N79-31766*# South Carolina Univ., Columbia. College of Engineering.
WEB-DENDRITIC GROWTH Final Report, Oct. 1975 - Aug. 1977
R. B. Hilborn, J. W. Faust, Jr., and Curtis Rhodes Aug. 1977 186 p
(Contracts NAS7-100; JPL-954344)
(NASA-CR-162175; DOE/JPL-954344-78/1) Avail: NTIS HC A09/MF A01 CSCL 10A

The effects of various machine design parameters on the growth of web dendritic silicon ribbon were investigated. Ribbons were grown up to lengths of one meter, with widths increasing linearly up to one cm at the point of termination of growth. Thermal data were collected and evaluated for actual seeding and growth with variations in parameters affecting heat loss. It was found that for suitable growth, the mechanical system should be very rigid and stable, and the tolerances and specifications of the quartz crucibles must be far tighter than normal quartz tolerances. The widening rates of the ribbons were found to be a function of the temperature gradient rather than the temperature differences alone. A twin spacing in the seed of 3 microns to 2 microns was found to be unfavorable for growth; whereas spacing of 0.9 microns to 2 microns and 8 microns to 2 microns were favorable. Thermal modeling studies of the effects of furnace design parameters on the temperature distributions in melt and the growth of the dendritic web ribbon showed that the pull rate of the ribbon is strongly dependent on the temperature of the top thermal shield, the spacing between this shield and the melt, and the thickness of the growing web. K.L.

N79-31767*# Solarex Corp., Rockville, Md.
DEVELOPMENT OF AN IMPROVED HIGH EFFICIENCY THIN SILICON SOLAR CELL Quarterly Report
G. Storti and C. Wrigley Jul. 1979 18 p Prepared for JPL
(Contracts NAS7-100; JPL-954883)
(NASA-CR-162159; SX/115/7Q; QR-7) Avail: NTIS HC A02/MF A01 CSCL 10A

Breakage and front contact failure in high efficiency, textured ultrathin cells was reduced as a consequence of the introduction of process modifications. In a small production run, over one hundred ultrathin cells, having an average AMO efficiency of 13%, were fabricated from 10-25 ohm cm silicon. An in-house aluminum paste for back surface field formation was developed that resulted in cell efficiencies equivalent to those from commercial pastes. The quality of the back surface field was found to be dependent on the orientation of the silicon slice during alloying. G.Y.

N79-31768*# Energy Materials Corp., Harvard, Mass.
LOW COST SOLAR ARRAY PROJECT. TASK 1: SILICON MATERIAL, GASEOUS MELT REPLENISHMENT SYSTEM Quarterly Progress Report, 17 Apr. - 17 Jul. 1979
D. N. Jewett, H. E. Bates, and D. M. Hill Jul. 1979 26 p refs Prepared for JPL and DOE
(Contract JPL-955269)
(NASA-CR-162270; DOE/JPL-955269-79-1; DRL-113; QPR-1) Avail: NTIS HC A03/MF A01 CSCL 10A

A system to combine silicon formation, by hydrogen reduction of trichlorosilane, with the capability to replenish a crystal growth system is described. A variety of process parameters to allow sizing and specification of gas handling system components was estimated. M.M.M.

N79-31769*# Pennsylvania Univ., Philadelphia. School of Electrical Engineering.
ANALYSIS AND EVALAUTION IN THE PRODUCTION PROCESS AND EQUIPMENT AREA OF THE LOW-COST SOLAR ARRAY PROJECT Quarterly Report, Jan. - Apr. 1979
H. Goldman and M. Wolf Jun. 1979 176 p refs Sponsored by NASA and DOE Prepared for JPL
(Contract JPL-954796)
(NASA-CR-162163; DOE/JPL-954796-79/6) Avail: NTIS HC A09/MF A01 CSCL 10A

The manufacturing methods for photovoltaic solar energy utilization are assessed. Economic and technical data on the current front junction formation processes of gaseous diffusion and ion implantation are presented. Future proposals, including modifying gaseous diffusion and using ion implantation, to decrease the cost of junction formation are studied. Technology developments in current processes and an economic evaluation of the processes are included. A.W.H.

N79-31770*# Westinghouse Research and Development Center, Pittsburgh, Pa.
SILICON MATERIALS TASK OF THE LOW COST SOLAR ARRAY PROJECT, PHASE 3. EFFECT OF IMPURITIES AND PROCESSING ON SILICON SOLAR CELLS Quarterly Report, Apr. - Jun. 1979
R. H. Hopkins, J. R. Davis, P. D. Blais, A. Rohatgi, R. B. Campbell, P. Rai-Choudhury, R. E. Stapleton, H. C. Mollenkopf (Hemlock Semiconductor Corp.), and J. R. McCormick (Hemlock Semiconductor Corp.) Jul. 1979 78 p refs Sponsored by NASA Prepared for JPL
(Contract JPL-954331)
(NASA-CR-162276; QR-15; DOE/JPL-954331-79/7) Avail: NTIS HC A05/MF A01 CSCL 10A

The effects of impurities, various thermochemical processes, and any impurity process interactions on the performance of terrestrial silicon solar cells are defined. Determinations of the segregation coefficients of tungsten, tantalum, and cobalt for the Czochralski pulling of silicon single crystals are reported. Sensitive neutron activation analysis was used to determine the metal impurity content of the silicon while atomic absorption was used to measure the metal content of the residual liquid from which the doped crystals were grown. Gettering of Ti doped silicon wafers improved cell performance by one to two percent for the highest temperatures and longest times. The HCl is more

effective than POCl3 treatments for deactivating Ti but POCl3 and HCl produced essentially identical results for Mo or Fe.
A.W.H.

N79-31771*# Sensor Technology, Inc., Chatsworth, Calif.
AUTOMATED ARRAY ASSEMBLY TASK IN-DEPTH STUDY OF SILICON WAFER SURFACE TEXTURIZING Quarterly Technical Report, 14 Dec. 1978 - 31 Mar. 1979
Gregory T. Jones, Sanjeev Chitre, Sang S. Rhee, and Kimberly L. Allison Mar. 1979 51 p refs Sponsored by NASA and DOE Prepared for JPL
(Contract JPL-955266)
(NASA-CR-162161; DOE/JPL-955266-79/1; QTR-1) Avail: NTIS HC A04/MF A01 CSCL 10A

A low cost wafer surface texturizing process was studied. An investigation of low cost cleaning operations to clean residual wax and organics from the surface of silicon wafers was made. The feasibility of replacing dry nitrogen with clean dry air for drying silicon wafers was examined. The two stage texturizing process was studied for the purpose of characterizing relevant parameters in large volume applications. The effect of gettering solar cells on photovoltaic energy conversion efficiency is described.
A.W.H.

N79-31772*# Materials Research, Inc., Centerville, Utah.
QUANTITATIVE ANALYSIS OF DEFECTS IN SILICON Quarterly Progress Report, 1 Apr. - 31 Jun. 1979
R. Natesh, J. M. Smith, H. A. Qidwai, and T. Bruce 12 Jul. 1979 177 p refs Sponsored by NASA Prepared for DOE and JPL
(Contract JPL-954977)
(NASA-CR-162173; MRI-273; QPR-5; DOE/JPL-954977-79/8) Avail: NTIS HC A09/MF A01 CSCL 10A

The evaluation and prediction of the conversion efficiency for a variety of silicon samples with differences in structural defects, such as grain boundaries, twin boundaries, precipitate particles, dislocations, etc. are discussed. Quantitative characterization of these structural defects, which were revealed by etching the surface of silicon samples, is performed by using an image analyzer. Due to different crystal growth and fabrication techniques the various types of silicon contain a variety of trace impurity elements and structural defects. The two most important criteria in evaluating the various silicon types for solar cell applications are cost and conversion efficiency.
A.W.H.

N79-31773*# Sensor Technology, Inc., Chatsworth, Calif.
ARRAY AUTOMATED ASSEMBLY TASK LOW COST SILICON SOLAR ARRAY PROJECT, PHASE 2 Annual Technical Report
Sang S. Rhee, Gregory T. Jones, and Kimberly L. Allison 1978 187 p refs Sponsored by NASA Prepared for DOE and JPL
(Contract JPL-954865)
(NASA-CR-162174; DOE/JPL-954865-79/5) Avail: NTIS HC A09/MF A01 CSCL 10A

Progress in the development of solar cells and module process steps for low-cost solar arrays is reported. Specific topics covered include: (1) a system to automatically measure solar cell electrical performance parameters; (2) automation of wafer surface preparation, printing, and plating; (3) laser inspection of mechanical defects of solar cells; and (4) a silicon antireflection coating system. Two solar cell process steps, laser trimming and holing automation and spray-on dopant junction formation, are described.
K.L.

N79-31774*# AeroChem Research Labs., Inc., Princeton, N. J.
DEVELOPMENT OF A MODEL AND COMPUTER CODE TO DESCRIBE SOLAR GRADE SILICON PRODUCTION PROCESSES Quarterly Report
R. Srivastava and R. K. Gould Aug. 1979 19 p refs Sponsored by NASA and DOE Prepared for JPL
(Contract JPL-954862)
(NASA-CR-162160; AeroChem-TN-207; DOE/JPL-954862-79/7; QR-7) Avail: NTIS HC A02/MF A01 CSCL 10A

The program aims at developing mathematical models and computer codes based on these models, which allow prediction of the product distribution in chemical reactors for converting gaseous silicon compounds to condensed-phase silicon. The major interest is in collecting silicon as a liquid on the reactor walls and other collection surfaces. Two reactor systems are of major interest, a SiCl4/Na reactor in which Si(l) is collected on the flow tube reactor walls and a reactor in which Si(l) droplets formed by the SiCl4/Na reaction are collected by a jet impingement method. During this quarter the following tasks were accomplished: (1) particle deposition routines were added to the boundary layer code; and (2) Si droplet sizes in SiCl4/Na reactors at temperatures below the dew point of Si are being calculated.
G.Y.

N79-31775*# Crystal Systems, Inc., Salem, Mass.
SILICON INGOT CASTING: HEAT EXCHANGER METHOD. MULTI-WIRE SLICING: FIXED ABRASINE SLICING TECHNIQUE, PHASE 3 Quarterly Progress Report, 1 Apr. - 30 Jun. 1979
Frederick Schmid and Chandra P. Khattak Jun. 1979 34 p refs Sponsored by NASA Prepared for DOE and JPL
(Contract JPL-954373)
(NASA-CR-162182; DOE/JPL-954373-79/11; QPR-3) Avail: NTIS HC A03/MF A01 CSCL 10A

Ingot casting was scaled up to 16 cm by 16 cm square cross section size and ingots weighing up to 8.1 kg were cast. The high degree of crystallinity was maintained in the large ingot. For large sizes, the nonuniformity of heat treatment causes chipping of the surface of the ingot. Progress was made in the development of a uniform graded structure in the silica crucibles. The high speed slicer blade-head weight was reduced to 37 pounds, allowing surface speeds of up to 500 feet per minute. Slicing of 10 cm diameter workpieces at these speeds increased the through-put of the machine to 0.145 mm/min.
K.L.

N79-31776*# Honeywell Corporate Material Sciences Center, Bloomington, Minn.
SILICON-ON CERAMIC PROCESS: SILICON SHEET GROWTH AND DEVICE DEVELOPMENT FOR THE LARGE-AREA SILICON SHEET AND CELL DEVELOPMENT TASKS OF THE LOW-COST SOLAR ARRAY PROJECT Quarterly Report, 2 Apr. - 29 Jun. 1979
P. W. Chapman, J. D. Zook, J. D. Heaps, B. L. Grung, B. Koepke, and S. B. Schuldt 31 Jul. 1979 66 p refs Sponsored in part by DOE Prepared for JPL
(Contracts NAS7-100; JPL-954356)
(NASA-CR-162158; DOE/JPL-954356-79/2; QR-12) Avail: NTIS HC A04/MF A01 CSCL 10A

The technical and economic feasibility of producing solar cell-quality silicon was investigated. This was done by coating one surface of carbonized ceramic substrates with a thin layer of large-grain polycrystalline silicon from the melt. Significant progress in the following areas was demonstrated: (1) fabricating a 10 sq cm cell having 9.9 percent conversion efficiency; (2) producing a 225 sq cm layer of sheet silicon; and (3) obtaining 100 microns thick coatings at pull speed of 0.15 cm/sec, although approximately 50 percent of the layer exhibited dendritic growth.
G.Y.

N79-31777*# Union Carbide Corp., New York.
LOW-COST SOLAR ARRAY PROJECT. FEASIBILITY OF THE SILANE PROCESS FOR PRODUCING SEMICONDUCTOR-GRADE SILICON Final Report, Oct. 1975 - Mar. 1979
Jun. 1979 362 p refs Prepared for JPL
(Contracts NAS7-100; JPL-954334)
(NASA-CR-162172) Avail: NTIS HC A16/MF A01 CSCL 10A

The feasibility of Union Carbide's silane process for commercial application was established. An integrated process design for an experimental process system development unit and a commercial facility were developed. The corresponding commercial plant economic performance was then estimated.
R.E.S.

N79-31778*# Clemson Univ., S.C. Dept. of Electrical and Computer Engineering.
ENGINEERING AREA INVESTIGATION OF RELIABILITY ATTRIBUTES AND ACCELERATED STRESS FACTORS ON TERRESTRIAL SOLAR CELLS Quarterly Report, 9 Mar. -

1 Jul. 1979
J. W. Lathrop and J. L. Prince 15 Jul. 1979 57 p refs
(NASA-CR-162165; DOE/JPL-954929-79/5; QR-5) Avail: NTIS HC A04/MF A01 CSCL 10A

Results obtained include the definition of a simplified stress test schedule for terrestrial solar cells based on the work performed during the first program year, and the design and fabrication of improved jigs and fixtures for electrical measurement and stress testing. Implementation of these advanced techniques for accelerated stress testing is underway on three solar cell types. In addition, review of the literature on second quadrant phenomena was begun and some preliminary second-quadrant electrical measurements were performed. Results obtained at the first down time for 75 C B-T testing and biased and unbiased T-H pressure cooker testing of type F cells showed little or no degradation in electrical parameters. Significant physical effects (large solder bubbles) were noted for type F cells subjected to the pressure cooker stress test. Author

N79-31779*# National Aeronautics and Space Administration, Washington, D. C.
INVESTIGATION OF A GENERATOR SYSTEM FOR GENERATING ELECTRICAL POWER, TO SUPPLY DIRECTLY TO THE PUBLIC NETWORK, USING A WINDMILL
C. Tromp Aug. 1979 159 p refs Transl. into ENGLISH of "Onderzoek aan een Generatorsystem voor het Opwekken van, Direkt aan het Openbare Net te Leveren, Elektrische Energie Net Behulp van een Windmolen" Delft Univ. of Technol., Power Electron. Lab., Netherlands, May 1957 122 p Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75497) Avail: NTIS HC A08/MF A01 CSCL 10B

A windpowered generator system is described which uses a windmill to convert mechanical energy to electrical energy for a three phase (network) voltage of constant amplitude and frequency. The generator system controls the windmill by the number of revolutions so that the power drawn from the wind for a given wind velocity is maximum. A generator revolution which is proportional to wind velocity is achieved. The stator of the generator is linked directly to the network and a feed converter at the rotor takes care of constant voltage and frequency at the stator. A.W.H.

N79-31780*# Alabama Univ., University. Dept. of Physics and Astronomy.
DEVELOPMENT OF SURFACES OPTICALLY SUITABLE FOR FLAT SOLAR PANELS Final Report
Aug. 1979 46 p refs Prepared for DOE
(Contract NAS8-32481)
(NASA-CR-161290) Avail: NTIS HC A03/MF A01 CSCL 10A

A reflectometer which can separately evaluate the spectral and diffuse reflectivities of surfaces is described. A phase locked detection system for the reflectometer is also described. A selective coating on aluminum potentially useful for flat plate solar collector applications is presented. The coating is composed of strongly bound copper oxide (divalent) and is formed by an etching process performed on an aluminum alloy with high copper content. Fabrication costs are expected to be small due to the one stop fabrication process. A number of conclusions gathered from the literature as to the required optical properties of flat plate solar collectors are discussed. A.W.H.

N79-31781*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DISCHARGE CHARACTERISTICS OF 300 AMPERE-HOUR Ni-Zn TRACTION CELLS
John G. Ewashinka Aug. 1979 11 p
(NASA-TM-79244; E-151) Avail: NTIS HC A02/MF A01 CSCL 10C

Preliminary tests were performed on 300 amphere-hour nickel-zinc cells containing the Lewis improved inorganic-organic (I/O) separator. These cells also have other design features included to optimize performance and cycle life. The tests carried out were formation tests and characteristic discharge tests. Information obtained include case temperature and maximum power delivered. A.R.H.

N79-31782# Scientific Service, Inc., Redwood City, Calif.
OPPORTUNITIES FOR ENERGY CONSERVATION IN FINISHED CONCRETE PRODUCTS Final Report
J. V. Zaccor and J. Jewett Sep. 1978 104 p refs
(Contract EC-77-S-03-1549)
(HCP/CS-1549) Avail: NTIS HC A06/MF A01

Two energy convservation opportunities are identified as applicable to the finished concrete products industry. One involves substituting a naturally cementitious material, pozzolan, for a portion of the cement, and the other involves the application of an appropriate insulation to achieve thermal isolation of material needlessly cycled with the product. A.W.H.

N79-31783# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho.
ENERGY CONSERVATION WITH FIRED HEATERS
Neil G. Cox and W. Paul Jensen Dec. 1978 65 p refs
(Contract EY-76-C-07-1570)
(TREE-1308) Avail: NTIS HC A04/MF A01

The energy consumption and the energy conservation potential with the operation of fired heaters in the petroleum refining and petrochemical industries are examined. Data were gathered to estimate the current and anticipated energy usage of fired heaters. The progress made in energy conservation efforts by the industries is assessed. Energy conservation limits with current technology are estimated and any needed for furthering energy conservation in the use of fired heaters is identified. A.W.H.

N79-31784*# United Technologies Corp., South Windsor, Conn. Power Systems Div.
STRIP CELL TEST AND EVALUATION PROGRAM Final Report, 15 Jun. 1976 - 30 Apr. 1977
B. Gitlow, W. F. Bell, and R. E. Martin 27 Oct. 1978 76 p refs
(Contract NAS3-20042)
(NASA-CR-159652; FCR-0945) Avail: NTIS HC A05/MF A01 CSCL 10B

The performance characteristics of alkaline fuel cells to be used for space power systems were tested. Endurance tests were conducted on the cells during energy conversion operations. A feature of the cells fabricated and tested was the capability to evaporate the product water formed during the energy conversion reaction directly to space vacuum. A fuel cell powerplant incoporating these cells does not require a condenser and a hydrogen recirculating pump water separator to remove the product water. This simplified the fuel cell powerplant system, reduced the systems weight, and reduced the systems parasite power. A.W.H.

N79-31785# GTE Labs., Inc., Waltham, Mass.
INVESTIGATION OF METHODS TO ELIMINATE VOLTAGE DELAY IN Li/SOCl2 CELLS Quarterly Technical Report, 19 Sep. - 19 Dec. 1978
C. Schlaikjer, C. A. Young, and M. Dobrusin Mar. 1979 27 p refs
(Contract DAAB07-78-C-0558; DA Proj. 1L1-61102-AH-47)
(AD-A069522; DELET-TR-78-0558-1; HISA-FM-195-78; QTR-1) Avail: NTIS HC A03/MF A01 CSCL 10/3

The rate of growth of lithium chloride films on lithium in thionyl chloride containing 1.8 M LiAlCl4 and 1.8 M LiAlCl4 with 0.001 M AlCl3 has been measured at 25 C, 55 C, and 72 C, using a pulse technique. The measured capacitance and micropolarization were used to calculate the thickness and resistivity of the films. It has been found to date that the rate of growth slows drastically after a few days of standing and the films assume a nearly constant thickness. This thickness is less when a slight excess of AlCl3 is present, but not when the storage temperature is lower. The polyhedral borate salts Li2B10Cl10 and Li2B12Cl12 have been synthesized from decaborane according to techniques described in the literature. Similar measurements of LiCl film growth on lithium in SOCl2 containing these salts are planned. GRA

N79-31786# Sandia Labs., Albuquerque, N. Mex.
EFFECT OF HEAT TREATMENT ON THE ELECTRICAL RESISTANCE OF PHOTORESIST AS RELATED TO RADIOISOTOPIC THERMOELECTRIC GENERATOR AGING
R. T. Johnson, Jr. Mar. 1979 20 p refs

(Contract EY-77-C-04-0789)
(SAND-79-0320) Avail: NTIS HC A02/MF A01

Annealing studies on the photoresist studied show that the resistance of the photoresist decreases by over five orders of magnitude upon annealing to 500 C, with a corresponding decrease in activation energy from 0.27 eV (350 C anneal) to 0.10 eV (500 C anneal). Time dependent decreases in resistance of the photoresist were also measured for up to 8 to 9 days during high temperature anneals. Some electrolytic transport of tungsten may occur through the photoresist at high temperatures. Results are compared with data on thermoelectric generators and show that photoresist could cause the electrical aging (voltage degradation) problem observed in some generators. DOE

N79-31787# Brookhaven National Lab., Upton, N. Y.
SOAR (SOLAR ASSISTED REACTOR) POWER SYSTEM
R. F. Benenati and J. R. Powell 1979 5 p ref Presented at the ANS Ann. Meeting, Atlanta, 3 Jun. 1979
(Contract EY-76-C-02-0016)
(BNL-25633; Conf-790602-29) Avail: NTIS HC A02/MF A01

The concept of utilizing solar energy as a supplementary energy source for hybrid power plants in which the main input is nuclear or coal is discussed. Low and intermediate temperature solar collectors can supply feedwater heat and/or reheat steam after expansion in a high pressure turbine. The Comanche Peak nuclear plant was selected for the study. A flowsheet with all feedwater heaters and the steam reheater using solar heat is given. The increased plant output is plotted as a function of the number of solar feedwater heaters. Author (DOE)

N79-31788# Illinois Univ., Urbana.
ENERGY AND LABOR INTENSITIES PROJECTED TO THE YEAR 2010
B. Hannon and A. R. Pleskun Sep. 1978 162 p refs
(Contract EM-78-S-02-4628)
(COO-4628-2) Avail: NTIS HC A08/MF A01

Total (direct and indirect) energy and labor intensities were projected to the year 2000 for a 40-sector economy. Energy intensities were derived by modifying the CONAES results with four possible energy price change scenarios between 1975 and 2010. Labor intensities were projected using data from the CAC model and projected BLS matrices to approximate the effect of a doubling of energy prices between 1975 and 2010. As an illustrative example, the projected data were used to determine the net energy andemployment impacts of the National Energy Plan on residential energy use to the year 2000. DOE

N79-31789# Argonne National Lab., Ill.
SOLAR ENERGY PROGRAM Annual Report, 1978
Feb. 1979 95 p refs
(Contract W-31-109-eng-38)
(ANL-79-16) Avail: NTIS HC A05/MF A01

The work done at Argonne National Laboratory on the Solar Energy Program during FY 1978 (July 1, 1977 to June 30, 1978) is described. Areas included in this report are solar energy collection, heating and cooling, thermal energy storage, ocean thermal energy conversion, photovoltaics, satellite power systems, bioconversion, central receiver solar thermal power, and wind energy conversion. DOE

N79-31790# Department of Energy, Washington, D. C. Energy Information Administration.
END-USE ENERGY-CONSUMPTION DATA BASE. VERSION 10: USER'S MANUAL
M. Maloney Feb. 1979 94 p refs
(DOE/EIA-0175) Avail: NTIS HC A05/MF A01

The end use energy consumption data base contains estimates of United States energy consumption categorized by fuel type, section of the economy, end use, and geographic area. Eight sectors are considered: agriculture, mining, construction, manufacturing, transportation, commercial, household, and electric utilities. Consumption estimates are at the national, census-division, and state levels, except for the household and commercial sectors, which are only at the national and census-division levels. The version of the data base described by this manual (version 110) contains consumption estimates for 1967, 1971, and 1974; the commercial sector estimates are for 1974 only. Future versions will contain estimates for 1975. The data base exists in two forms: as a sequential file on tape and as a random access file on computer. The random access file must be accessed by use of the data base management system. DOE

N79-31791# Brookhaven National Lab., Upton, N. Y. National Center for Analysis of Energy Systems.
LONG-TERM STRATEGIC ANALYSIS (TOWARDS AN ENERGY DOCTRINE)
Kenneth C. Hoffman and Steven C. Carhart Nov. 1978 30 p refs Presented at the Intern. Sci. Form on an Acceptable World Energy Future, Miami, 27 Nov. - 1 Dec. 1978
(Contract EY-76-C-02-0016)
(BNL-25250; Conf-781129-1) Avail: NTIS HC A03/MF A01

The formulation of long-term energy strategies requires the synthesis of a large number of economic, social, technical, and environmental factors with due regard to regional and international needs and constraints. An approach to strategic analysis in the energy sector is outlined. Emphasis is placed on the logic of the approach to strategic planning and analysis. DOE

N79-31792# Department of Energy, Washington, D. C. Office of the Controller.
DEPARTMENT OF ENERGY FY 1980 OBLIGATIONS
5 Feb. 1979 341 p
(DOE/CR-0005) Avail: NTIS HC A15/MF A01

Detailed estimates are shown for the respective states based on existing contracts and grants which were assumed to continue in 1980. Some programs could not be identified at the contractor level, and some elements of programs could not be identified by states. These are listed in an undesigned category. DOE

N79-31793# Argonne National Lab., Ill.
HIGH-PERFORMANCE BATTERIES FOR ELECTRIC-VEHICLE PROPULSION AND STATIONARY ENERGY STORAGE Progress Report, Oct. 1977 - Sep. 1978
P. A. Nelson, D. L. Barney, and R. K. Steunenberg Nov. 1978 246 p refs
(Contract W-31-109-eng-38)
(ANL-78-94) Avail: NTIS HC A11/MF A01

High-temperature batteries for electric vehicle propulsion and stationary energy storage applications were developed. The cells, which operate at 400 to 500 C, are of a vertically oriented, prismatic design with one or more inner positive electrodes of FeS or FeS2, facing electrodes of lithium-aluminum alloy, and molten LiCl KCl electrolyte. Development of a 40 kWh battery (Mark IA) for testing in an electric van was initiated and conceptual design studies on a 100 MWh stationary energy storage module were conducted. Multiplate cells, which are capable of higher performance than bicells, were developed. DOE

N79-31794# Department of Energy, Washington, D. C.
SOLAR THERMAL POWER SYSTEMS, PROGRAM SUMMARY
Dec. 1978 280 p refs
(DOE/ET-0078) Avail: NTIS HC A13/MF A01

Each of DOE's Solar Thermal Power Systems projects funded and/or in existence during FY 1978 is described and the status as of September 30, 1978 is reflected. These projects are divided as follows: small thermal power applications, large thermal power applications, and advanced thermal technology. Also included are: 1978 project summary tables, bibliography, and an alphabetical index of contractors. DOE

N79-31795# TRW, Inc., McLean, Va. Energy Systems Planning Div.
ANALYSIS OF INVESTMENT ALTERNATIVES TO STIMULATE DEVELOPMENT AND TECHNOLOGY TRANSFER FOR ENERGY TECHNOLOGIES, SOLAR PHOTOVOLTAICS, A CASE STUDY
Sep. 1978 151 p refs
(Contract ET-78-C-05-5670)
(TID-28968) Avail: NTIS HC A08/MF A01

The return on investment that could be achieved by building a plant with the aid of six types of incentives was simulated based on five distinct plant designs. Descriptions and results of these analyses are presented. The general decision tree analysis

in which other options are considered is illustrated. Using the residential market as a testbed, and for a variety of types or applications within the residential market, the significance of the balance-of-system costs issue is addressed in some detail. A survey of the photovoltaic industry is presented and the potential impact of incentives on the future competitiveness of the industry is discussed. Details of the methodology used to simulate corporate responses to inventive programs and computational details for balance-of-system costs are presented. DOE

N79-31796# Sandia Labs., Albuquerque, N. Mex.
SUMMARY OF APPLICATION ANALYSIS FOR PHOTOVOLTAIC SYSTEMS
G. J. Jones and J. L. Watkins 1979 12 p refs Presented at DOE Battery Storage Workshop, Denver, Colo., 11 Jan. 1979
(Contract EY-76-C-04-0789)
(SAND-78-0980C; Conf-790138-1) Avail: NTIS HC A02/MF A01

The cost effectiveness of consumer-owned photovoltaic systems was analyzed. The results indicate cost effectiveness in many regions in 1986 and everywhere by 2000, providing DOE price goals are met and battery storage is considered an integral part of only smaller (residential, remote) photovoltaic systems. The economic justification of battery storage in larger systems, especially utility owned ones, is relatively independent of the presence of the photovoltaic array. The greatest general area of uncertainly in all sectors is the utility-customer interface for consumer owned systems, and the worth of the photovoltaic system to the utility for utility owned systems. DOE

N79-31797# Department of Energy, Washington, D. C.
DOMESTIC POLICY REVIEW OF SOLAR ENERGY
Feb. 1979 146 p
(TID-28834) Avail: NTIS HC A07/MF A01

Solar technologies and government policy towards competing fuels were assessed and existing Federal solar energy programs were evaluated. Solar energy's potential contributions to national and international needs are identified. Three options for future government policy are presented and specific initiatives which could be adopted to implement each are described. DOE

N79-31798# Department of Energy, Washington, D. C. Energy Information Administration.
MACROECONOMIC AND SECTOR IMPLICATIONS OF INSTALLING 2.2 MILLION RESIDENTIAL SOLAR UNITS
R. F. Earley, M. M. Mohtadi, E. L. Rossidivito, and H. Weisman Apr. 1979 102 p refs
(DOE/EIA-0102/51) Avail: NTIS HC A06/MF A01

The macroeconomic sector, and employment implications of cumulatively installing 2.2 million solar heating and hot water units through 1985 are analyzed. K.L.

N79-31799# Midwest Research Inst., Golden, Colo.
IMPLEMENTATION OF STATE SOLAR INCENTIVES: RESEARCH, DEVELOPMENT, AND DEMONSTRATION PROGRAMS
B. Green Feb. 1979 41 p refs
(Contract EG-77-C-01-4042)
(SERI/TR-51-161) Avail: NTIS HC A03/MF A01

The states view high-risk, capital-intensive R, D, and D solar projects as being most appropriately performed by the federal government and private industry. For the states, solar energy R, D, and D programs function primarily in support of commercialization efforts. The close programmatic relationship between solar energy R, D, and D and commercialization efforts at the state level is a function of a more-immediate or near-term emphasis within state-level programs, some states perceive their solar energy R, D, and D programs as predominantly a commercialization activity. Available R, D, and D incentives at the state level are reviewed and the implementation of research programs in New Mexico, Montana, California, and Florida is described. The following are included: a catalog of state solar energy R, D, and D programs; the choice of case-study states; program-implementation experience in the case-study states; and observations, recommendations, and conclusions. DOE

N79-31800# Midwest Research Inst., Golden, Colo.
ROLE OF EDUCATION AND TRAINING PROGRAMS IN THE COMMERCIALIZATION AND DIFFUSION OF SOLAR ENERGY TECHNOLOGIES
B. Burns, B. Mason, and K. Armington Jan. 1979 56 p refs
(Contract EG-77-C-01-4042)
(SERI/RR-53-128) Avail: NTIS HC A04/MF A01

An important part of analyzing employment and labor force requirements in the solar energy field is determining the availability of trained and experienced workers and of programs to provide additional training. A base for analysis of these labor force supply questions by identifying the importance of education and training in the commercialization and diffusion of solar technologies is provided, issues for planning and analysis of solar education and training efforts are discussed, and the range of programs and courses presently available is illustrated. Four general perspectives are reviewed, on the diffusion of a new technology such as solar energy systems, with special attention to the education and training issues. DOE

N79-31801# Argonne National Lab., Ill.
ASSESSMENT OF NATIONAL CONSEQUENCES OF INCREASED COAL UTILIZATION, EXECUTIVE SUMMARY, VOLUME 1
Feb. 1979 89 p refs Prepared in cooperation with BNL, California Univ., Berkeley Lawrence Berkeley Lab., LASL, ORNL, and Battelle Pacific Northwest Labs. Sponsored by DOE
(TID-29425-Vol-1) Avail: NTIS HC A05/MF A01

Environmental constraints to reaching the coal use goals of the NEP were analyzed. The major constraint, air quality, arises primarily because of the postulated siting of power plants and coal-burning industries in or near areas where air quality standards are currently violated and 'prevention of significant deterioration' class 1 and 2 areas. Further air quality constraints may arise from potential short-term violations of National Ambient Air Quality Standards for total suspended particulates and SO2. These constraints may affect 35 percent of projected for the NEP. Other constraints discussed are: long range sulfur transport as dioxide and sulfates, health effects of air pollution, water quality and availability, solid waste disposal, socio-economic effects, economics (capital and labor investment required), occupational health and safety (accidents in mining and transporting coal), etc. DOE

N79-31802# Argonne National Lab., Ill.
ASSESSMENT OF NATIONAL CONSEQUENCES OF INCREASED COAL UTILIZATION, EXECUTIVE SUMMARY, VOLUME 2
Feb. 1979 346 p refs Prepared in cooperation with BNL, California Univ., Berkeley Lawrence Berkeley Lab., LASL, ORNL, and Battelle Pacific Northwest Labs. Sponsored by DOE
(TID-29425-Vol-2) Avail: NTIS HC A15/MF A01

The constraints to reaching National Energy Plan (NEP) coal use goals were analyzed. The major constraint, air quality, involves the siting of utility and industrial sources in or near nonattainment areas or prevention of significant deterioration class 1 and 2 areas. Further restrictions arise from potential short term SO2 and total suspended particulates National Ambient Air Quality Standards violations. Implementation of NEP initiatives should not cause major public health impacts. Water quality and water availability constraints on site specific bases are expected. Solid waste does not appear to be a constraint for achieving NEP coal use goals. Neither national economic nor regional socioeconomic impacts appear to cause major restrictions. There may be socioeconomic impacts on a local basis where large scale energy facilities will be located in areas of low assimilative capacity. DOE

N79-31803# AIA Research Corp., Washington, D. C.
PASSIVE SOLAR DESIGN: A SURVEY OF MONITORED BUILDINGS
Oct. 1978 360 p refs
(Contract EG-77-C-01-4113)
(HCP/CS-4113-2) Avail: NTIS HC A16/MF A01

This survey consists of collected articles reporting the thermal performance of buildings using passive solar techniques, plus a matrix tabulating the information contained in the reports, and a verbal summary of the results. Most of the articles were published previously; additional information was gathered from

owners and designers and is attached as an addendum to the articles. DOE

N79-31804# AIA Research Corp., Washington, D. C.
PASSIVE SOLAR DESIGN: AN EXTENSIVE BIBLIOGRAPHY
Dec. 1978 210 p
(Contract EG-77-C-01-4113)
(HCP/CS-4113-3) Avail: NTIS HC A10/MF A01

Approximately 2445 citations on passive solar design are presented. Materials included in major data banks as of January, 1978 are included along with the proceedings of the Second National Passive Conference. Subject areas include agriculture, costs, design concepts, greenhouses, energy storage, and evaporation. DOE

N79-31805# Midwest Research Inst., Golden, Colo.
CLASSIFICATION SCHEME FOR THE COMMON PASSIVE AND HYBRID HEATING AND COOLING SYSTEMS
Michael J. Holtz, W. Place (California Univ., Berkeley. Lawrence Berkeley Lab.), and R. C. Kammerud (California Univ., Berkeley. Lawrence Berkeley Lab.) Feb. 1979 9 p refs Presented at 3d Natl. Passive Solar Conf., San Jose, Calif., 11 Jan. 1979
(Contract W-7405-eng-48)
(LBL-8814; Conf-790118-6) Avail: NTIS HC A02/MF A01

A systematic nomenclature and classification scheme is proposed for passive space heating and cooling systems. It is based upon the mode of energy transport to and from the space and the environmental resource from which the energy is received or to which it is discharged. A number of passive and hybrid space heating and cooling systems are characterized. DOE

N79-31806# Sandia Labs., Albuquerque, N. Mex.
HELIOS MODEL FOR THE OPTICAL BEHAVIOR OF REFLECTING SOLAR CONCENTRATORS
F. Biggs and C. N. Vittitoe Mar. 1979 324 p refs
(Contract EY-76-C-04-0789)
(SAND-76-0347) Avail: NTIS HC A14/MF A01

The Helios model simulates the optical behavior of reflecting concentrators. The model follows the incident solar radiation through the system (including the atmosphere) and includes all the factors that influence the optical performance of a collector. An important output is the flux-density pattern at a grid of points on a surface such as the absorbing surface of a receiver and its integral (power in watts) over the surface. The angular distribution of sunrays for the radiation incident on a concentrator is modified by convolution to incorporate the effects of other nondeterministic factors. The analytical methods used for the statistics, the off-axis reflecting optics, the atmospheric effects, and the various coordinate systems are described and illustrated. This model forms a basis for the simulation code HELIOS as well as for other codes under development. Some of the HELIOS routines are described. DOE

N79-31807# Market Facts, Inc., Washington, D. C.
PASSIVE SOLAR ENERGY FOCUS GROUP RESULTS
1978 44 p
(Contract EV-78-C-01-6458)
(DOE/TIC-10016) Avail: NTIS HC A03/MF A01

The following are covered: the current state of passive solar energy, barriers to the commercialization of passive solar energy, possible actions for surmounting barriers to commercialization, and the role of the Federal Government in commercialization passive solar energy. Author (DOE)

N79-31808# Midwest Research Inst., Golden, Colo.
IMPLEMENTATION OF STATE SOLAR INCENTIVES: STATE TESTING AND CERTIFICATION
Robert Odland Mar. 1979 38 p refs
(Contract EG-77-C-01-4042)
(SERI/TR-51-162) Avail: NTIS HC A03/MF A01

Implementation experiences of four states (Florida, California, Minnesota, and Oregon) with testing and certification programs were examined in order to: (1) provide information to other states and local governments that are contemplating adoption and implementation of such programs; (2) provide information to the Federal government for their use in formulating national policies recognize and accommodate regional diversity. Florida and California have testing and certification programs, both currently voluntary although certification in Florida will be required after January 1, 1980, and certification in California may be made a condition of their state income tax credit. Minnesota has a system whereby the characteristics of solar equipment are to be disclosed to the buyer; the manufacturer is charged with developing the necessary information. Oregon has several programs that require qualifying standards or criteria to be developed. One Oregon program requires certification by a state agency. DOE

N79-31809# Battelle Pacific Northwest Labs., Richland, Wash.
HELIOSTAT REFLECTIVE SURFACE SUBSTRATE CHARACTERIZATION
N. R. Gordon Nov. 1978 29 p refs
(Contract EY-76-C-06-1830)
(PNL-2810) Avail: NTIS HC A03/MF A01

Reflective surface substrates were characterized and specifications tasks are presented. The properties of foam core sandwich construction were emphasized. The relationship between viscoelastic deformation of the adhesive and deflection of the mirror module was investigated. DOE

N79-31810# Department of Energy, Washington, D. C. Office of Energy Research.
SOCIAL ASSESSMENT OF ON-SITE SOLAR ENERGY TECHNOLOGIES
Apr. 1979 251 p refs
(Grant EG-77-S-01-4040)
(HCP/R-4040-02) Avail: NTIS HC A12/MF A01

The results of an assessment of the impact of on-site solar energy technology upon society are presented. The assessment utilizes the methodology of social indicators. Twenty-five appropriate social descriptions provide the framework for assessing the technologies of solar space heating and cooling, solar water heating, wind energy conversion, fuelwood and photovoltaics. The report concentrates upon those areas which cause concern as these forms of solar energy realize increasing acceptance and usage by individual citizens. DOE

N79-31811# Argonne National Lab., Ill.
QUALIFICATION OF STAINLESS STEEL FOR OTEC HEAT EXCHANGER TUBES
F. L. LaQue Jan. 1979 25 p refs
(Contract W-31-109-eng-38)
(ANL/OTEC-001) Avail: NTIS HC A02/MF A01

The history of the AL-6X alloy was reviewed and its credentials as a candidate for use as tubing in ocean thermal energy conversion (OTEC) heat exchangers were examined. Qualification was based on results of accelerated tests using ferric chloride for resistance to crevice corrosion and pitting, long time crevice and pitting tests in natural sea water and anticipated resistance to attack by ammonia and mixtures of ammonia and sea water. The satisfactory behavior indicated by the various accelerated and long time corrosion tests were confirmed by excellent performance of several million feet of tubing in condensers in coastal power plants. The available data qualify the AL-6X alloy as being a satisfactory alternate to titanium for tubes in OTEC heat exchangers. DOE

N79-31812# Illinois Univ. at Chicago Circle, Chicago. Dept. of Energy Engineering.
COMPARATIVE STUDY OF WORKING FLUIDS FOR OTEC POWER PLANTS
E. N. Ganic and J. Wu Jan. 1979 48 p refs
(Contract W-31-109-eng-38)
(ANL/OTEC-TM-1) Avail: NTIS HC A03/MF A01

The effect of three different working fluids (ammonia, propane, and freon) on the size of ocean thermal energy conversion (OTEC) heat exchangers was analyzed. Seven different combinations of shell-and-tube heat exchangers were considered. For each combination, a simple computer model of the OTEC power system was used to compare the three fluids. The comparison was made on the basis of A/W sub net, where A is the total heat transfer area (evaporator plus condenser) and W sub net is the net power output of the plant. Overall, ammonia is shown to be the best fluid (i.e., it yields the lowest value of A/W sub net), although in some cases only by a small margin. The

thermophysical property that gives ammonia its general superiority is the relatively high thermal conductivity. The report also discusses heat exchanger design problems associated with liquid entrainment and boiling liquid superheat. DOE

N79-31813# Department of Energy, Washington, D. C. Office of Conservation and Solar Applications.
PASSIVE SOLAR ENERGY PLANNING AID KIT FOR BUILDING DESIGN ARCHITECTS AND PLANNERS
1978 97 p refs Presented at the 2d Natl. Passive Solar Conf., Philadelphia, 16 Mar. 1978
(Contract EM-78-C-01-4228)
(CONF-780337-P1) Avail: NTIS HC A05/MF A01

Fourteen articles are presented each containing building design and planning information for passive solar energy application. The articles are organized into three catagories: (1) planning and analysis, (2) residential buildings, and 3) office buildings. In a separate section passive design ideas are given along with planning consideration tips. DOE

N79-31814# Department of Energy, Washington, D. C. Office of Conservation and Solar Applications.
PASSIVE SOLAR ENERGY PLANNING AID KIT FOR THE BUSINESS COMMUNITY AND GENERAL PUBLIC
1978 124 p Presented at the 2d Natl. Passive Solar Conf., Philadelphia, 16 Mar. 1978
(Contract EM-78-C-01-4228)
(CONF-780337-P2) Avail: NTIS HC A06/MF A01

Twenty-three articles are presented each containing information representative of some planning aid aspect of the state of the art in passive solar energy. The articles are organized into four categories: (1) passive solar approach, (2) real buildings in different locations, (3) greenhouses and greenrooms, and (4) design ideas and illustrations. R.E.S.

N79-31815# Department of Energy, Washington, D. C. Office of Conservation and Solar Applications.
PASSIVE SOLAR ENERGY PLANNING AID KIT FOR SOLAR ENERGY SYSTEMS ENGINEERS
1978 106 p refs Presented at the 2d Natl. Passive Solar Conf. Philadelphia, 16 Mar. 1978
(Contract EM-78-C-01-4228)
(CONF-780337-P3) Avail: NTIS HC A06/MF A01

Separate abstracts were prepared for eleven of the included papers. The remaining two papers appeared previously in ERA. Author (DOE)

N79-31816# Midwest Research Inst., Golden, Colo.
GENERATOR GAS: THE SWEDISH EXPERIENCE FROM 1939-1945
Jan. 1979 334 p refs Transl. into ENGLISH of the book "Gengas" Stockholm, Swedish Academy of Engineering, 1950 334 p
(Contract EG-77-C-01-4042)
(SERI/SP-33-140) Avail: NTIS HC A15/MF A01

The scientific, technical, and commercial information developed during World War 2 when Sweden, cut off from fossil fuels, converted 40% of its entire motor vehicle fleet to burning wood is summarized. Topics discussed include: (1) history; (2) the theory of gas generation; (3) generator gas fuels; (4) shape and design of the gas generator; (5) cooling and cleaning of generator gas; (6) adoption of generator gas for motor operation; (7) adaptation of engines to generator gas for motor operation; (8) gas generator installation; (9) garage and services; (10) practical operating experience; (11) the economics of generators gas operations; and (12) the hazards of generator gas operation. DOE

N79-31817# Department of Energy, Washington, D. C.
THERMAL AND MECHANICAL ENERGY STORAGE PROGRAM
Mar. 1979 184 p
(DOE/ET-0091) Avail: NTIS HC A09/MF A01

DOE's Division of Energy Systems is supporting a broad range of projects to conserve energy and to make possible shifting away from oil and natural gas by developing central power generation, dispersed power generating, solar and waste heat utilization, and vehicle propulsion. Categories on mechanical and magnetic energy storage, and chemical/hydrogen energy stoage are addressed. DOE

N79-31818# Department of Energy, Washington, D. C.
BRIEFING RELATED TO EXECUTIVE ORDER 12003 AND THE NATIONAL ENERGY ACT
Nov. 1978 63 p
(Contract EM-77-C-01-8962)
(DOE/TIC-10065) Avail: NTIS HC A04/MF A01

The following briefings are discussed: (1) Managerial Plan Executive Order 12003 and the National Energy Act (NEA), the Plan is outlined and some of the historical background that preceded the presidential issuance of EO 12003 program are covered; (2) Roles and Responsibilities of EO 12003, NEA, and other authorities; (3) impact of the NEA on the Federal Energy Management Program; and (4) proposed interagency Task Group, designated as the Federal Energy Management and Policy Group. Supporting graphics for the briefings are included. DOE

N79-31819# Battelle Pacific Northwest Labs., Richland, Wash.
ANALYSIS OF FEDERAL INCENTIVES USED TO STIMULATE ENERGY PRODUCTION
B. W. Cone, D. L. Brenchley, and V. L. Brix Dec. 1978 400 p refs
(Contract EY-76-C-06-1830)
(PNL-2410-1-Rev) Avail: NTIS HC A17/MF A01

Federal incentives for the development of solar energy are studied and recommendations for the development of a solar energy policy based upon cost incentives for competing energy sources are made. The cost incentives for the other forms of energy are identified and analyzed. Federal incentives to stimulate energy research and development with respect to alternate energy sources are examined. A.W.H.

N79-31820# Unified Industries, Inc., Alexandria, Va.
RECOMMENDED CHANGES TO EXECUTIVE ORDER 12003 AND RELATED AUTHORITIES
27 Oct. 1978 9 p
(Contract EM-77-C-01-8962)
(DOE/TIC-10066) Avail: NTIS HC A02/MF A01

Executive Order (EO) 12003, directing that all federal agencies set the example in conservation by upgrading the efficiency of all government buildings and operations so as to achieve sizable energy savings, is discussed. Adjustments to the EO 12003 definition of a building is required to eliminate the need to include leased (new) buildings in the 45 percent energy reduction requirement. Ten changes directed at EO 12003 are presented in a table. DOE

N79-31821# Oak Ridge Associated Universities, Tenn. Inst. for Energy Analysis.
ENERGY POLICY AND MATHEMATICS
A. M. Weinburg Mar. 1979 22 p refs
(Contract EY-75-C-05-0033)
(ORAU/IEA-79-5(0)) Avail: NTIS HC A02/MF A01

Mathematics as it applies to the energy policy and energy policy analysis is discussed. The author suggests that the undecidability of energy estimates of the future may to some degree be finessed by the development of technological options whose feasibility can be established through the help of deterministic mathematics. DOE

N79-31822# Department of Energy, Washington, D. C. Div. of Magnetohydrodynamics.
US-USSR COLLOQUIUM ON MAGNETOHYDRODYNAMIC ELECTRICAL POWER GENERATION
1978 889 p refs Colloq. held at Washington, D. C., 5-6 Oct. 1978
(CONF-781009) Avail: NTIS HC A99/MF A01

Thirty American and English language translated Russian papers are presented on various aspects of magnetohydrodynamics (MHD) as it relates to electric power generation. The papers are organized into five catagories: (1) analysis MHD systems, (2) design and testing of MHD channels, (3) subsidiary MHD components, (4) materials, and (5) diagnostic studies. DOE

N79-31823# Unified Industries, Inc., Alexandria, Va.
ANALYSIS AND UPDATE OF ROLES AND RESPONSIBILI-

TIES DERIVED FROM EXECUTIVE ORDER 12003 AND RELATED AUTHORITIES
31 Oct. 1978 51 p refs
(Contract EM-77-C-01-8962)
(DOE/TIC-10064) Avail: NTIS HC A04/MF A01

All program activities that DOE should perform as part of its management responsibilities for carrying out the President's directive for conserving energy in Federal buildings and operations are identified and analyzed. Activities in which DOE should not become involved are also identified. The basic authorities include: the Energy Policy and Conservation Act 381 (1975), Executive Order 11912 (1976), Public Law 95-91 (1977), Executive Order 12003 (1977), and the proposed National Energy Act. A summary of the authorities applicable to the Federal Energy Management Program are given. Based on the analyses, twelve recommendations are presented as strategies for DOE to carry out the initiatives. DOE

N79-31824# Honeywell, Inc., Minneapolis, Minn. Energy Resources Center.
BUILDINGS ENERGY MANAGEMENT PROGRAM WORKSHOP DESIGN Final Report
Dec. 1978 66 p refs
(Contract EM-76-C-01-8630)
(CONS-8630-T1) Avail: NTIS HC A04/MF A01

Activities undertaken for design and development of the format, content, and materials that were used in conducting 129 one-day energy management workshops for specific commercial business audiences are described. The Building Energy Management Workshop Program was part of a National Workshop Program that was intended to increase awareness of energy-related issues and to encourage energy-conservation actions on the part of commercial and industrial sectors. DOE

N79-31825# Sandia Labs., Albuquerque, N. Mex.
HAZARDOUS PROPERTIES AND ENVIRONMENTAL EFFECTS OF MATERIALS USED IN SOLAR HEATING AND COOLING (SHAC) TECHNOLOGIES: INTERIM HANDBOOK
J. Q. Searcy, ed. Aug. 1978 226 p refs
(Contract EX-76-C-04-0789)
(SAND-78-0842) Avail: NTIS HC A11/MF A01

General background information related to SHAC systems, how a particular material was chosen for this handbook, and codes and standards are given. The following are included: classification scheme and general properties of materials used in SHAC systems; chemical composition, thermal degradation products, and thermoxidative products; toxic properties and other potential health effects of SHAC materials, fire hazard properties of SHAC materials; and environmental effects of and disposal for SHAC materials. DOE

N79-31826# Department of Energy, Washington, D. C. Office of Conservation and Solar Applications.
MANAGERIAL PLAN: EXECUTIVE ORDER 12003 AND THE NATIONAL ENERGY ACT, PROPOSED, SYNOPSIS
Sep. 1978 18 p refs
(Contract EM-77-C-01-8962)
(DOE/TIC-10062) Avail: NTIS HC A02/MF A01

Upgrading the efficiency of all government buildings and operations to achieve sizable energy savings is considered. A managerial plan developed as a basic document to serve the needs of various levels of management is summarized. DOE

N79-31827# Hydroscience, Inc., Knoxville, Tenn.
ASSESSMENT OF LONG-DISTANCE THERMAL-ENERGY TRANSPORT: A COMPARISON BETWEEN WATER, STEAM, AND HOT OILS
Mar. 1979 96 p refs
(Contract W-7405-eng-26)
(ORNL/SUB-79/14274/1) Avail: NTIS HC A05/MF A01

Capital and operating costs required to supply low to moderate temperature (120 deg to 130 deg) thermal energy via a long distance pipeline system were assessed. Preliminary sizing calculations were performed and basic design requirements were developed. The cases studied involved short (8 km), intermediate (24 km), and long (64 km) transport distances as well as low (273 GJ/hr), intermediate (1370 GJ/hr), and high (4100 GJ/hr) levels of heat input. Thermal energy delivery costs are computed for each case to determine which systems are most economical to construct and operate. Energy outputs were studied for hot water at 1200 C, saturated steam at 177 C, and saturated steam at 249 C. DOE

N79-31828# Exxon Research and Engineering Co., Linden, N. J.
FUEL CELL CATALYST SINTERING STUDIES Final Report
Y. C. Pan and G. Ciprios Jul. 1978 104 p refs
(EPRI-EM-833) Avail: NTIS HC A03/MF A01

The impact of phosphorous chemistry in controlling the sintering phenomenon in phosphoric acid fuel cells was investigated. Extensive sintering tests were carried out on Pt catalysts supported on P-100 and other H3PO4 activated carbons from different manufacturers. These tests were conducted at temperatures ranging from 130 C and potentials ranging from +100 mV/SCE to +800 mV/SCE. The results with these supports show good sintering resistance at temperatures below 170 C and potentials up to +700 mV/SCE. At higher temperatures or potentials, such as those representative of FCG-1 operating conditions, the catalysts sintered at measurable rates. However, it was found that the phosphorus content of these spent catalysts had decreased, and furthermore, that the Pt crystallite stability was directionally consistent with the phosphorus retention data. DOE

N79-31829# Argonne National Lab., Ill.
FEASIBILITY OF DISTRICT HEATING OF NORTHERN US CITIES BY COGENERATION
D. J. Santini, A. A. Davis, and S. M. Marder 1978 19 p refs Presented at 1st Conf. on Energy and Community Development, Athens, Greece, 10 Jul. 1978
(ANL/EES-CP-18; Conf-780744-1) Avail: NTIS HC A02/MF A01

A study is summarized that examines the engineering and economic feasibility of providing district heating to six major northern U.S. central cities by utlizing cogenerated electrical and thermal energy from retrofit of existing power plants. The four major components of the analysis are discussed, namely: (1) demand estimation, (2) supply analysis, (3) transmission/distribution design, and (4) approximation of operations. A cost comparison to three coal-based heating alternatives is made. In addition to costs, energy savings are illustrated for the district-heating technology. Results indicate that cogeneration-based district heating is a technology worthy of continued evaluating by the U.S. DOE

N79-31830# Argonne National Lab., Ill.
APPLICATION OF AIR EJECTORS TO THE PERFORMANCE IMPROVEMENT AND COST REDUCTION OF COMPRESSED AIR STORAGE POWER PLANTS
F. W. Ahrens, T. T. Ng, and D. R. Otis 1978 27 p refs Presented at CAES Technol. Symp., Pacific Grove, Calif., 15 May 1978
(Contract W-31-109-eng-38)
(CONF-780599-1) Avail: NTIS HC A03/MF A01

Ways in which air ejectors could be integrated into compressed air energy storage (CAES) power systems in order to achieve a reduction in costly air storage volume and a possible savings in air compression work are explored. Primary emphasis is given to a scheme involving multiple constant-volume caverns, with the pumping effect of the air ejector replacing the wasteful throttling process. The results cover a range of ejector efficiency and CAES system design conditions. It appears that volume reductions of 20 to 30% or more and compression work savings of 2 to 4% can be achieved. DOE

N79-31831# Gulf Universities Research Consortium, Bellaire, Tex.
REQUIREMENTS FOR THE DEVELOPMENT, MANAGEMENT AND IMPLEMENTATION OF RESEARCH IN SUPPORT OF THE DEPARTMENT OF ENERGY ENHANCED OIL RECOVERY PROGRAM
C. R. Hocott and R. H. Maier Feb. 1979 114 p
(Contract EX-76-C-01-2025)
(BETC-2025-1; GURC-163A) Avail: NTIS HC A06/MF A01

Recommendations concerning a supplemental research

program for enhanced oil recovery (EOR) are outlined. A program of studies to identify, describe, and quantify geologic and geochemical factors, which have a major influence on EOR processes, should be initiated. The interactions within EOR systems and the interactions between fluid system components and rocks and fluids in the reservoir environment should be studied as a unified program. Dialogue and exchange of data and materials between laboratory investigations and field tests should be promoted and, for some projects, should be a requirement. Research programs which are not as developed as the surfactant-polymer program should be expanded. Comprehensive systems and procedures must be adopted soon for the collection, analysis, filing dissemination, and interchange of data being developed in the different program sections. DOE

N79-31832# Boeing Engineering and Construction, Seattle, Wash.

CENTRAL RECEIVER DESIGN CONSIDERATIONS FOR BRAYTON CYCLE SOLAR POWER PLANTS

J. R. Gintz and R. C. Zentner 1978 21 p refs Presented at Symp. on Solar-Thermal Power Stations, Cologne, West Ger., 12 Apr. 1978 Prepared for EPRI

(EPRI Proj. RP-377-1)

(AED-Conf-78-212-016; Conf-780425-13) Avail: NTIS (US Sales Only) HC A02/MF A01; DOE Depository Libraries

A central solar power plant utilizing gas turbine machinery for the power conversion cycle is described. The design requirements, design rationale, thermal performance, and technical feasibility of the receiver system are discussed. The cavity receiver concept and initial receiver configurations are examined. Candidate materials to satisfy the design requirements for a commercial sized receiver are evaluated. DOE

N79-31833# International Research and Development Co. Ltd., Newcastle (England).

DESIGN OPTIMIZATION OF SOLAR CELL INTERCONNECTORS AND WIRING FOR LOW ORBIT SPACECRAFT

D. L. Kemp, D. Robson, C. Y. Marples, R. B. Evans, and P. F. Arthur Nov. 1978 129 p refs

(Contract ESA-2849/76-NL-HP(SC))

(IRD-78/36; ESA-CR(P)-1175) Avail: NTIS HC A07/MF A01

Theoretical models were developed to study the stress levels in silver plated molybdenum and silver mesh interconnectors which are currently used in solar arrays. A test rig was developed to measure the behavior of these interconnectors between room temperature and -170 C to enable the theoretical results to be verified. The models allow one end of an interconnector to be displaced and rotated in relation to the other and the resulting maximum induced stress of the interconnecor to be determined. Using the theoretical model a new optimized interconnector was designed within the constraints of the current operating conditions. The designed silver plated molybdenum interconnector was manufactured and tested. The fatigue results show a significant improvement in performance. Temperature effects were also studied. Author (ESA)

N79-31834# Societe des Accumulateurs Fixes et de Traction, Romainville (France). Dept. Accumulateurs.

REPORT ON THE DEVELOPMENT OF SILVER HYDROGEN BATTERIES Final Report [DEVELOPPEMENT DE L'ARGENT HYDROGENE]

P. Antoine Jan. 1979 382 p In FRENCH

(Contract ESTEC-2994/76)

(DI/SAS-061/79-PA/MLC; ESA-CR(P)-1213) Avail: NTIS HC A17/MF A01

The feasibility of silver hydrogen batteries was experimentally studied in order to identify specific problems relative to the construction of this type of battery given the constraints that the device should have a mass to energy ratio of 80 Whr/kg and a service life comparable to Ni-Cd and Ni-H2 systems. Ten different design prototypes were built and their characteristics are given. The evaluation of the prototypes involved electrical cycles typically encountered on board satellites situated in low altitude or geostationary orbits. Problems specific to silver electrodes were studied as they effectively determine the mass to energy ratio of the system. Results permit a practical estimation to be made of the mass to energy ratio of the Ag-H2 system while identifying an optimal Ag electrode. Author (ESA)

N79-31835# Office National d'Etudes et de Recherches Aerospatiales, Toulouse (France). Dept. d'Etudes et de Recherches en Technologie Spatiale.

ON THE DEVELOPMENT OF A MATERIAL WHICH IS BOTH A SOLAR REFLECTOR AND A GOOD ELECTRIC CONDUCTOR Final Report [MISE AU POINT DE MATERIAUX COMBINANT LA QUALITE DE REFLECTEUR SOLAIRE ET UNE BONNE CONDUCTIBILITY ELECTRIQUE, TOME 2]

A. Paillous and D. Sarrail Feb. 1979 121 p refs In FRENCH

(Contract ESTEC-3184/N477-HP(SC))

(ONERA-CERT-4064; ESA-CR(P)-1214) Avail: NTIS HC A06/MF A01

The fabrication and characteristics of solar reflector second surface mirrors (SSM) on Teflon covered by transparent electrically conductive layers are described. The use of an electrically conductive polymeric film for SSM's is also studied. For both types of material the solar absorptivity versus emitter characteristics is examined. In order to determine the rate of degradation in the optical properties of the multilayer surfaces studied, a space environment solar radiation simulation test involving exposure to ultraviolet irradiation for approximately 1000 solar equivalent hours was devised. Results show the Teflon surface performs better given these test conditions. However, suggestions for improving the polymeric surface are made and it is supposed that it is potentially as good as the Teflon.

Author (ESA)

N79-31836# National Technical Information Service, Springfield, Va.

WIND POWER, VOLUME 2. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1977 - Apr. 1979

Audrey S. Hundemann Jun. 1979 282 p Supersedes NTIS/PS-78/0416; NTIS/PS-77/0399; NTIS/PS-76/0358; NTIS/PS-75/348; COM-74-11103

(NTIS/PS-79/0534/2; NTIS/PS-78/0416; NTIS/PS-77/0399; NTIS/PS-76/0358; NTIS/PS-75/348; COM-74-11103) Avail: NTIS HC $28.00/MF $28.00 CSCL 10B

This bibliography contains 276 citations on the feasibility, use, and engineering aspects of wind power and windmills. The use of wind power for electric power generation and wind turbine design and performance is examined. Comparative analyses of wind power and alternative energy soures are included, as are energy storage devices which can be used in these systems.

GRA

N79-31837# National Technical Information Service, Springfield, Va.

WIND POWER, VOLUME 1. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - 1977

Audrey S. Hundemann Jun. 1979 225 p

(NTIS/PS-79/0535/9) Avail: NTIS HC $28.00/MF $28.00 CSCL 10B

This bibliography contains 210 citations on windmill and wind power feasibility, use, and engineering. The use of wind power for electric power generation and wind turbine design and performance is reported. The use of wind power in developing countries and comparative analyses of wind power and alternative energy sources are included, as are studies on energy storage systems. GRA

N79-31838# National Technical Information Service, Springfield, Va.

WIND POWER, VOLUME 2. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1978 - Apr. 1979

Audrey S. Hundemann Jun. 1979 131 p Supersedes NTIS/PS-78/0417; NTIS/PS-77/0400; NTIS/PS-76/0359

(NTIS/PS-79/0536/7; NTIS/PS-78/0417; NTIS/PS-77/0400; NTIS/PS-76/0359) Avail: NTIS HC $28.00/MF $28.00 CSCL 10B

Windmill and wind power feasibility, use, and engineering are discussed in these citations of world-wide research. Abstracts primarily cover the use of wind power for electric power generation

and wind turbine design and performance. General studies dealing with the use of wind power in developing countries and comparative analyses of wind power and alternative energy sources are included, as are studies on energy storage systems. This updated bibliography contains 125 abstracts, 113 of which are new entries to the previous edition. GRA

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N79-31839*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
REMOTE MONITORING OF THE GRAVELLY RUN THERMAL PLUME AT HOPEWELL AND THE THERMAL PLUME AT THE SURRY NUCLEAR POWER PLANT ON THE JAMES RIVER
T. A. Talay, K. W. Sykes (Army Corps of Engineers, Norfolk, Va.), and C. Y. Kuo (Virginia Polytechnic Inst. and State Univ., Blacksburg) Jul. 1979 21 p refs Presented at the Virginia Academy of Science, 56th Ann. Meeting, Blacksburg, 9-12 May 1978
(NASA-TM-80124) Avail: NTIS HC A02/MF A01 CSCL 13B

On May 17, 1977, a remote sensing experiment was conducted on the James River, Virginia, whereby thermal spectrometer and near-infrared photography data of thermal discharges at Hopewell and the Surry nuclear power plant were obtained by an aircraft for one tidal cycle. These data were used in subsequent investigations into the near field discharge trajectories. For the Gravelly Run thermal plume at Hopewell, several empirical expressions for the plume centerline were evaluated by comparisons of the computed trajectories and those observed in the remote sensing images. Author

N79-31840*# Massachusetts Inst. of Tech., Cambridge.
AIR POLLUTION FROM AIRCRAFT Final Report, Feb. 1969 - Oct. 1978
John B. Heywood, James A. Fay, and Norman A. Chigier (Sheffield Univ., England) 26 Jun. 1979 43 p refs
(Grant NGR-22-009-378)
(NASA-CR-162284) Avail: NTIS HC A03/MF A01 CSCL 13B

Forty-one annotated abstracts of reports generated at MIT and the University of Sheffield are presented along with summaries of the technical projects undertaken. Work completed includes: (1) an analysis of the soot formation and oxidation rates in gas turbine combustors, (2) modelling the nitric oxide formation process in gas turbine combustors, (3) a study of the mechanisms causing high carbon monoxide emissions from gas turbines at low power, (4) an analysis of the dispersion of pollutants from aircraft both around large airports and from the wakes of subsonic and supersonic aircraft, (5) a study of the combustion and flow characteristics of the swirl can modular combustor and the development and verification of NO sub x and CO emissions models, (6) an analysis of the influence of fuel atomizer characteristics on the fuel-air mixing process in liquid fuel spray flames, and (7) the development of models which predict the stability limits of fully and partially premixed fuel-air mixtures. R.E.S.

N79-31841*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CARBON MONOXIDE MEASUREMENT IN THE GLOBAL ATMOSPHERIC SAMPLING PROGRAM
Thomas J. Dudzinski Sep. 1979 26 p refs
(NASA-TP-1526; E-9972) Avail: NTIS HC A03/MF A01 CSCL 13B

The carbon monoxide measurement system used in the NASA Global Atmospheric Sampling Program (GASP) is described. The system used a modified version of a commercially available infrared absorption analyzer. The modifications increased the sensitivity of the analyzer to 1 ppmv full scale, with a limit of detectability of 0.02 ppmv. Packaging was modified for automatic, unattended operation in an aircraft environment. The GASP system is described along with analyzer operation, calibration procedures, and measurement errors. Uncertainty of the CO measurement over a 2-year period ranged from + or - 3 to + or - 13 percent of reading, plus an error due to random fluctuation of the output signal + or - 3 to + or - 15 ppbv. Author

N79-31842# Aerospace Corp., El Segundo, Calif.
ARGON-ION CONTAMINATION OF THE PLASMASPHERE
Y. T. Chiu, J. M. Cornwall, J. G. Luhmann, and Michael Schulz 15 Jul. 1979 43 p refs Sponsored by DOE
(ATR-79(7824)-2) Avail: NTIS HC A03/MF A01

Observational and analytic knowledge is presented on effects of plasma beam interaction with the magnetosphere to the plasmasphere contamination problem of the argon ion engine exhaust expected to be deposited in the magnetosphere during the construction phase of the Satellite Power System. Effects of plasmasphere, ionosphere, and radiation belt modifications are discussed. G.Y.

N79-31843# Naval Research Lab., Washington, D. C.
THE 1978 NRL AIR QUALITY DATA Annual Summary Report
A. Stamulis 21 May 1979 24 p refs
(AD-A069964; NRL-MR-4010) Avail: NTIS HC A02/MF A01 CSCL 04/2

This report is a summary of the air quality data measured at NRL for the calendar year 1978. This annual summary is part of a continuing series of yearly reports initiated in 1975. The variables measured at the NRL air monitoring station include ozone, sulfur dioxide, nitrogen dioxide, total hydrocarbons, methane, carbon monoxide, wind speed, and wind direction. The instruments used to measure these variables are interfaced to the data acquisition system which in turn is coupled to a magnetic tape recorder. The data input is for one month on the tape which is subsequently analyzed by the air quality computer program at the NRL Research Computer Center and results in a monthly computer printout of the air quality data. Each monthly computer printout is then analyzed and a digest of the information obtained is reported as the yearly summary. Author (GRA)

N79-31844# Mitre Corp., McLean, Va.
NATIONAL ENVIRONMENTAL IMPACT PROJECTION NO. 1
Richard J. Kalaagher, Beth L. Borko, Deborah Elcock, Robert Kline, Andy Lawrence, Nazir Dossani, Alan D. Berstein, Thomas H. Piwowar, William P. Weygandt, and Marc Narkus-Kramer Feb. 1979 107 p refs Prepared in cooperation with CONSAD Res. Corp., Pittsburgh,Pa., Intern. Res. and Technol. Corp., Mclean, Va., and Control Data Corp., Minneapolis, Minn.
(Contract E-77-C-01-6119)
(HCP/P-6119) Avail: NTIS HC A06/MF A01

Environmental and economic impacts expected to result under the Energy Information Administration's energy supply and demand projections to 1990 are presented. DOE

N79-31845# Washington Univ., Seattle. Center for Quantitative Science in Forestry, Fisheries, and Wildlife.
ASSESSING THE IMPACT OF NUCLEAR-POWER PLANTS ON THE ENVIRONMENT Annual Progress Report
D. G. Chapman, D. P. Lettenmaier, A. H. Seymour, G. L. Swartzman, and H. E. Lawson Dec. 1978 179 p refs
(NUREG/CR-0552; APR-2) Avail: NTIS HC A09/MF A01

An assessment of the wide-ranging effects that nuclear power plants can have on the environment is presented. The effects include mortality to fish and other organisms resulting from impingement and entrainment in the cooling system; changes in behavioral and physiological characteristics of aquatic animals by higher temperatures present in the discharge plume; and toxic effects of biocides, heavy metals and radionuclides released in the aquatic or atmospheric environment. DOE

N79-31846# Stanford Univ., Calif. Dept. of Statistics.
KALMAN FILTERING METHOD AND ITS APPLICATION TO AIR POLLUTION EPISODE FORECASTING
P. Switzer and P. Zannetti Jan. 1979 27 p Sponsored in part by EPA and NSF
(Contract EY-76-S-02-2874)
(COO-2874-48; SU-TR-22) Avail: NTIS HC A03/MF A01

The Kalman filtering method was applied to multi-station air pollution modeling in order to obtain a useful real time predictor of concentration levels, especially during episode situations. Special attention was paid to avoiding certain high dimensionality problems of the Kalman filter while still retaining some of the deterministic physical information of the transport and diffusion phenomena. Moreover, a method is proposed to forecast future state values using only a probabilistic knowledge of future state-transition matrices, which is the most common situation in air pollution real time forecasting with probabilistic meteorological input. Specifically, the method was applied to SO2 and meteorological data. DOE

N79-31847# California Univ., Berkeley. Lawrence Berkeley Lab.

INDOOR AIR QUALITY IN ENERGY-EFFICIENT BUILDINGS

C. G. Hollowell, J. V. Berk, C. I. Lin, and I. Turiel Mar. 1979 14 p refs Presented at 2nd Intern. CIB Symp. on Energy Conservation in the Built Environ., Denmark, 27 May 1979

(Contract W-7405-eng-48)

(LBL-8892; Conf-790523-2) Avail: NTIS HC A02/MF A01

The relationship between ventilation rate and indoor air quality is being investigated with a mobile laboratory designed specifically for studies of indoor air quality and energy utilization in buildings before and after energy conservation retrofits, and in new buildings incorporating energy-efficient designs. The characterization program includes measurement of infiltration rate (continuous C2H6 and N2O tracer gas method), CO, CO2, NO, NO2, SO2, O3, formaldehyde, total aldehydes, radon and particulate mass and chemical composition. DOE

N79-31848# Oak Ridge National Lab., Tenn. Environmental Sciences Div.

ENVIRONMENTAL DATA: MANAGEMENT AND NEEDS ANALYSIS CONSIDERATIONS

R. H. Strand 1979 12 p refs Presented at 4th Ann. SAS User's Group Conf., Clearwater Beach, Fla., 28 Jan. 1979

(Contract W-7405-eng-26)

(CONF-790146) Avail: NTIS HC A02/MF A01

Considerations involved in the management of environmental data for analysis and evaluation are presented. The goals are to: (1) point out the variety of environmental data and how this variety puts emphasis on merging, sorting, and updating capabilities in a data management system; (2) emphasize that a successful data management system requires a complete definition by all customer of the problems requiring data management and the products that the data management system is expected to yield or enhance; and (3) encourage customers, implementors, and designers to document the problems to be addressed, capabilities to be developed, and products expected with a data management system. DOE

N79-31849# California Univ., Berkeley. Lawrence Berkeley Lab.

APPLICATION OF X-RAY EMISSION SPECTRA TO THE IDENTIFICATION OF PARTICULATE SULFUR COMPOUNDS IN AMBIENT AIR

A. J. Ramponi and J. M. Jaklevic Dec. 1978 19 p refs

(Contract W-7405-eng-48)

(LBL-7284) Avail: NTIS HC A02/MF A01

X-ray emission spectroscopy was found to be an effective method for the observation of the chemical form of particulate sulfur in ambient air. Realizing the unique spectral characteristics of sulfate, an instrument for analyzing pollution filters for sulfate concentrations was considered. A knowledge of the peak positions and relative peak intensities dispenses with the need to perform time consuming scans. A sealed, helium filled Bragg spectrometer that allows for precise external rotation of the diffracting crystal permits consecutive measurements of the peak counting rates. A detailed investigation of the K beta/K beta prime ratio (observed to be about 3 to 1) through a least squares comparison with a standard sulfate sample yields information concerning the sulfate concentration. Any counts remaining in the main peak after removing the sulfate contribution can be attributed to other forms of sulfur, most notably sulfides. DOE

N79-31850# Sandia Labs., Albuquerque, N. Mex.

IN SITU ENVIRONMENTAL SAMPLER (IES): DESCRIPTIVE ANALYSIS AND OPERATING PROCEDURES

F. R. Gustke Mar. 1979 109 p

(Contract EY-76-C-04-0789)

(SAND-78-1342) Avail: NTIS HC A06/MF A01

A self-contained, portable, analog tape-recording system was designed to record sample data on environments encountered during transportation. This highly versatile, rugged instrument will record in situ up to 14 channels of data, along with IRIG time and voice, with a maximum frequency response of dc to 5 kHz at tape speeds from 3-3/4 to 15 inches per second. The system and operating procedures for its use are described. DOE

N79-31851# Swedish Water and Air Pollution Research Lab., Goeteborg.

ROLE OF AMMONIA IN THE CHEMISTRY OF ATMOSPHERIC AEROSOLS

Cyrill Brosset Jun. 1978 34 p refs

(IVL-B-449) Avail: NTIS (US Sales Only) HC A03/MF A01; DOE Depository Libraries

In the years 1974 - 1976, investigations were carried out in different places in Sweden to determine the concentration of H+ and NH+4 in the water-soluble part of airborne fine particles. It was found that the concentration quotient H+/NH+4 varies in a rather systematic manner. This variation indicates that particles present in the air over an agricultural area take up ammonia. On the other hand, they seem to release this component when present over a forest district with acid lakes. Under equilibrium conditions, the quotient H+/NH+4 is dependent more or less directly on the atmospheric partial pressure of ammonia. DOE

N79-31852# Radian Corp., Austin, Tex.

PLAN FOR AIR POLLUTION RESEARCH IN THE TEXAS GULF COAST AREA. VOLUME 1: PLAN FOR AIR QUALITY STUDIES Final Report

Gary Tannahill, Bryan W. Lambeth, David Balfour, David Jones, and Joe Stuart Apr. 1979 96 p refs 5 Vol.

(Contract EPA-68-02-2955)

(PB-295912/0; EPA-600/8-79-008A-Vol-1) Avail: NTIS HC A05/MF A01 CSCL 13B

In order to study air pollution related problems in the Texas Gulf Coast area, existing technical information was reviewed, the local viewpoint on air pollution problems in the area was recorded, research needs were defined and experimental studies addressed to these needs were designed. An research plan for air quality studies is discussed. GRA

N79-31853# Southwest Research Inst., Houston, Tex.

PLAN FOR AIR POLLUTION RESEARCH IN THE TEXAS GULF COAST AREA. VOLUME 2: PLAN FOR HEALTH EFFECTS STUDIES Final Report

Donald E. Johnson and R. John Prevost Apr. 1979 61 p refs Prepared for Radian Corp., Austin, Tex. 5 Vol.

(Contract EPA-68-02-2955)

(PB-295913/8; EPA-600/8-79-008B-Vol-2) Avail: NTIS HC A04/MF A01 CSCL 13B

Available aerometric, health effects, demographic, and meteorologic data as well as other inputs resulting from public meetings were reviewed and considered in development of the plan. Documentation begins with a general assessment of area populations, air quality, and relevant health effects. Questions are addressed which must be answered in accomplishing a plan for health effects studies. The plan begins with detailed discussion of the general research needs of the area regarding health effects and presents a set of hypotheses which need to be addressed with specific studies. The plan culminates with description of twelve types of studies considered to be most useful in providing definitive answers. Relative priorities, time sequencing, and rough cost estimates are provided with the study descriptions. GRA

N79-31854# Radian Corp., Austin, Tex.

PLAN FOR AIR POLLUTION RESEARCH IN THE TEXAS GULF COAST AREA. VOLUME 3: SUMMARY OF PREVIOUS AIR QUALITY STUDIES AND DATA Final Report

Bryan W. Lambeth, Barbara J. Maxey, and William P. Stadig

Apr. 1979 303 p refs 5 Vol.
(Contract EPA-68-02-2955)
(PB-295914/6; EPA-600/8-79-008C-Vol-3) Avail: NTIS HC A14/MF A01

All available air pollution related information concerning air pollution (emissions, measurements, and meteorology) for the Houston area is presented. Air pollution emissions data summaries, air quality monitoring site information, air quality data summaries, and additional meteorological information are included. A bibliography with abstracts is provided for the topics of emissions, monitoring, meteorology, and control, which are relevant to the Texas Gulf Coast study. GRA

N79-31855# Radian Corp., Austin, Tex.
PLAN FOR AIR POLLUTION RESEARCH IN THE TEXAS GULF COAST AREA. VOLUME 5: LOCAL VIEWPOINTS ON RESEARCH NEEDS Final Report
Bryan W. Lambeth and Gary Tannahill Apr. 1979 284 p refs 5 Vol.
(Contract EPA-68-02-2955)
(PB-295915/3; EPA-600/8-79-008E-Vol-5) Avail: NTIS HC A13/MF A01 CSCL 13B

A public meeting was held in Houston to solicit information and viewpoints on air pollution problems in the Houston area and related research needs. Testimonies given by local technical experts, respresentatives of industrial organizations, education institutions, citizens groups, and private individuals are presented as well as those given at Congressional hearings pursuant to Section 403(d) of the 1977 Clean Air Act. GRA

N79-31856# Research Corp. of New England, Wethersfield, Conn.
TECHNICAL MANUAL FOR THE MEASUREMENT AND MODELING OF NON-POINT SOURCES AT AN INDUSTRIAL SITE ON A RIVER Final Report, Jan. 1977 - May 1978
G. T. Brookman, J. J. Binder, P. B. Katz, and W. A. Wade, III Feb. 1979 83 p
(Contract EPA-68-02-2133)
(PB-295028/5; EPA-600/7-79-049) Avail: NTIS HC A05/MF A01 CSCL 13B

A measurement and modeling program for nonpoint sources at an industrial site on a river is presented. Criteria for developing a field survey program and model selection are provided, along with program costs and manpower requirements. A sample list of equipment and computer costs is also provided. The development of a field survey includes sample site selection, selection of parameters to be measured, number and frequency of samples, collection methods, analytical methods, and data reduction and analysis. The SSWMM-RECEIV-2 model which was adapted to a coal fired utility site is described. Application of the outlined procedures to the measurement of nonpoint sources from a coal fired utility is also presented. GRA

N79-31857# IIT Research Inst., Chicago, Ill.
SURVEY OF BIOLOGICAL TREATMENT IN THE IRON AND STEEL INDUSTRY Final Report, Aug. 1977 - Jan. 1978
D. F. Finn and J. D. Stockham Jan. 1979 28 p refs
(Contract EPA-68-02-2617)
(PB-295048/3; EPA-600/2-79-010) Avail: NTIS HC A03/MF A01 CSCL 13B

The current uses of biological treatment methods for iron and steel industry wastewater are surveyed. Identification and characterization, on a pollutant component basis, of waste streams receiving treatment are presented. Capabilities of biological treatment, advantages and disadvantages of various biological systems, nitrification and denitrification, current utilization of biological treatment by the industry, and possible alternatives to current biological methods are discussed. The coke plant, particularly its waste ammonia liquor, is the major wastewater source for biological treatment and is highlighted. GRA

N79-31858# Particle Data Labs. Ltd., Elmhurst, Ill.
EVALUATION OF PARTICULATE MASS MONITORS USING THE BETA GAUGE TECHNIQUE Final Report, Jun. 1973 - Feb. 1975
Meryl R. Jackson Apr. 1979 73 p refs
(Contract EPA-68-02-1216)
(PB-295055/8; EPA-600/2-79-073) Avail: NTIS HC A04/MF A01 CSCL 14B

Two commercially available beta gauge instruments for measuring particulate mass concentrations in stationary source emission were evaluated. Performance of the instruments was compared with a manual method of measurement at a ferrite rotary kiln calciner, a slurry cement kiln with an electrostatic precipitator, and an oil fired boiler. Tests were conducted over a 168-hour period to establish instrument accuracy, calibration error, drift and system reliability. The accuracy of the beta gauge instruments was strongly dependent upon the sampling characteristics of the extractive probes. The instruments tested were not capable of correctly measuring the particulate concentration in the stack, nor of operating continuously for a 168 hour period. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation.*

N79-31859*# National Aeronautics and Space Administration, Washington, D. C.
RESULTS OF MEASUREMENT OF THE NIGHT CORPUSCULAR FLUX ON THE MR-12 ROCKETS IN THE JASPIC PROJECT (SOVIET PART OF THE PROGRAM)
S. I. Avdyushin, L. L. Bukusova, G. S. Ivanov-Kholodnyy, T. V. Kazachevskaya, M. A. Savelev, V. F. Tulinov, and V. M. Feygin Aug. 1979 11 p refs Transl. into ENGLISH of "Rezultaty Izmereniya Nochnogo Korpuskulyarnogo Potoka na Raketakh MR-12 po Proyektu JASPIC (Sovetskaya Chast Programmy)" Acad. of Sci. USSR, Moscow, 1979 7 p Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75691) Avail: NTIS HC A02/MF A01 CSCL 04A

In June 1978, a joint Soviet-American project (JASPIC) was conducted, the goals of which were: (1) the study of the flows of spilling electrons which act upon the middle-latitude ionosphere under nocturnal conditions (nocturnal corpuscular source of ionization); and (2) the mutual comparison of procedures for recording corpuscular radiations in the upper atmosphere, using meteorological and geophysical rockets. Author

N79-31860# California Inst. of Tech., Pasadena. Seismological Lab.
SHOCK-INDUCED EFFECTS IN CALCITE FROM CACTUS CRATER
J. Vizgirda, Thomas J. Ahrens, and Fun-Dow Tsay [1978] 42 p refs
(Contract DNA001-76-C-0218)
(Contrib-3267) Avail: NTIS HC A03/MF A01

Shock metamorphism of calcite from coralline limestone samples retrieved from a borehole drilled into the rocks beneath Cactus Crater, a nuclear explosion crater at Eniwetok Atoll, was detected and quantified using electron spin resonance (ESR). ESR spectra of Mn(2+), present as a trace constituent in the coral samples, show a consistent decrease in hyperfine peak splitting with decreasing depth of sample. A similar variation was observed in coral samples experimentally shocked to progressively higher pressures. It is speculated that the decrease in hyperfine peak splitting reflects a decrease in crystal field splitting and, hence, small (less than or equal to 0.01A) increases in cation-anion distances produced by mechanical energy input during the shock process. G.Y.

N79-31861# National Environmental Satellite Service, Washington, D. C. Meteorological Satellite Lab.
EARTH-ATMOSPHERE RADIATION BUDGET ANALYSES DERIVED FROM NOAA SATELLITE DATA JUNE 1974 - FEBRUARY 1978, VOLUME 1
Jay S. Winston, Arnold Gruber, Thomas I. Gray, Jr., Marylin S. Varnadore, Charles L. Earnest, and Luke P. Mannello Aug. 1979 346 p refs 2 Vol.
(NOAA-S/T-79-187-Vol-1) Avail: NTIS HC A15/MF A01

Earth-atmosphere radiation budget data determined from the

scanning radiometers aboard NOAA operational satellites are presented in analyzed mapped fields. Monthly, seasonal, and annual averages are given. The mapped data are displayed on a Mercator projection from 60 N to 60 S and polar stereographic projections poleward of 50 N and S. The quantities displayed are albedo, absorbed solar radiation, outgoing longwave radiation, and net radiation. K.L.

N79-31862# National Environmental Satellite Service, Washington, D. C. Meteorological Satellite Lab.

EARTH-ATMOSPHERE RADIATION BUDGET ANALYSES DERIVED FROM NOAA SATELLITE DATA JUNE 1974 - FEBRUARY 1978, VOLUME 2

Jay S. Winston, Arnold Gruber, Thomas I. Gray, Jr., Marylin S. Varnadore, Charles L. Earnest, and Luke P. Mannello Aug. 1979 336 p 2 Vol.

(NOAA-S/T-79-187-Vol-2) Avail: NTIS HC A15/MF A01

Zonal earth-atmosphere radiation data obtained by the scanning radiometers aboard NOAA operational satellites are displayed in meridional profiles. The quantities displayed are albedo, absorbed solar radiation, and outgoing longwave radiation. The profiles are based on monthly, seasonal, and annual means at every 2.5 latitude for the entire latitude circle and for three longitudinal sectors: 0 deg to 117.5 deg E, 120 deg E to 122.5 deg W, and 120.0 deg W to 2.5 deg W. K.L.

N79-31863*# Dartmouth Coll., Hanover, N.H. Thayer School of Engineering.

MAGNETOPAUSE STRUCTURE FROM SATELLITE OBSERVATIONS Final Technical Report, 1 Oct. 1977 - 30 Sep. 1978

Bengt U. O. Sonnerup 3 Oct. 1979 140 p refs

(Grants NsG-7292; NSF ATM-74-08223)

(NASA-CR-162286) Avail: NTIS HC A07/MF A01 CSCL 04A

Observations on magnetopause structure are reported. Major topics covered include: classical reconnection, transport mechanisms, magnetospheric boundary layers, tearing modes, and Jupiter's magnetopause. R.E.S.

N79-31864*# National Aeronautics and Space Administration, Washington, D. C.

APPLICATION OF SPACE TECHNOLOGY TO CRUSTAL DYNAMICS AND EARTHQUAKE RESEARCH

Aug. 1979 274 p refs

(NASA-TP-1464) Avail: NTIS HC A12/MF A01 CSCL 08K

In cooperation with other Federal government agencies, and the governments of other countries, NASA is undertaking a program of research in geodynamics. The present program activities and plans for extension of these activities in the time period 1979-1985 are described. The program includes operation of observatories for laser ranging to the Moon and to artificial satellites, and radio observatories for very long baseline microwave interferometry (VLBI). These observatories are used to measure polar motion, earth rotation, and tectonic plate movement, and serve as base stations for mobile facilities. The mobile laser ranging and VLBI facilities are used to measure crustal deformation in tectonically active areas. G.Y.

N79-31865# European Space Agency, Paris (France).

DEFINITION OF A EUROPEAN PROGRAM FOR EARTHQUAKE PREDICTION RESEARCH

T. D. Guyenne, ed. Apr. 1979 97 p refs Presented at ESA/Council of Europe Seminar, Strasbourg, 5-7 Mar. 1979

(SP-149) Avail: NTIS HC A05/MF A01

The state-of-the-art concerning earthquake prediction is reviewed in a series of 16 lectures covering different fields, such as national programs for earthquake monitoring and prediction, space techniques in earthquake prediction research, error analysis of geodetically derived strains, real-time monitoring and data acquisition, and strain and tilt measurements in seismic areas. For individual titles, see N79-31866 through N79-31880.

N79-31866# Kiel Univ. (West Germany). Inst. fuer Geophysik.

INTRODUCTION TO THE PROBLEM OF PREDICTING EARTHQUAKES

R. Meissner *In* ESA Definition of a European Program for Earthquake Prediction Res. Apr. 1979 p 3-6 refs (For primary document see N79-31865 22-46)

Avail: NTIS HC A05/MF A01

The present state of earthquake hazards and prediction is briefly reviewed. Much weight is put on recent results from laboratory and field investigations of dilatancy (the inelastic increase in volume which begins at about half of the fracture strength of rocks), and other phenomena related to the development of stress prior to an earthquake. The concept of seismic gaps, referring to a region along an active plate boundary that has not experienced a large earthquake for a long time, is extended in order to involve creep processes. All pre-, post-, and co-seismic creep processes are candidates for remote sensing by space techniques. A concentrated European effort on a selected site, preferably along the Alpine-Mediterranean plate boundary, is recommended in order to achieve a successful prediction system within the next decade. Author (ESA)

N79-31867# United Nations Educational, Scientific and Cultural Organization, Paris (France).

EARTHQUAKE PREDICTION AND RISK MANAGEMENT

E. M. dAlbe *In* ESA Definition of a European Program for Earthquake Prediction Res. Apr. 1979 p 7-10 (For primary document see N79-31865 22-46)

Avail: NTIS HC A05/MF A01

The practical aspects of earthquake prediction are situated within a general framework of safety management. It is noted that in order to reduce earthquake hazard not only a statement regarding the magnitude, location, and time of an expected earthquake is needed, but a knowledge of ground motion in the area surrounding the epicenter, possible damage to buildings, and potential loss of life or injury must be considered. It is proposed to define the risk, for decision making, as the product of value, vulnerability, and seismic hazard (probability of occurence of an earthquake within a given area and period of time). The assessment and eventual reduction of the risks are separately discussed. Author (ESA)

N79-31868# Freie Univ., Berlin (West Germany). Inst. fuer Geophysikalische Wissenschaften.

TERRESTRIAL AND SPACE TECHNIQUES IN EARTHQUAKE RESEARCH

Andreas Vogel *In* ESA Definition of a European Program for Earthquake Prediction Res. Apr. 1979 p 11-15 (For primary document see N79-31865 22-46)

Avail: NTIS HC A05/MF A01

A report is given on an international workshop which was held to discuss recent advances in experimental techniques for the monitoring of crustal dynamics in earthquake zones. Experts from countries throughout the world, who are concerned with earthquakes and earthquakes disaster prevention, participated and discussed various terrestrial as well as space techniques presently applied or most likely to become applicable in earthquake prediction research. It is proposed that the discussion of instrumental capabilities and natural limitations, the presentation of world-wide experiences and results of recent research, and the conclusions and future aspects documented in the proceedings of the workshop should be evaluated to provide a basis for an European research program on earthquake prediction and disaster prevention. Author (ESA)

N79-31869# Paris-Sud Univ., Orsay (France).

FRENCH PROGRAM FOR THE STUDY OF SEISMIC RISK [PROGRAMME FRANCAIS D'ETUDE DU RISQUE SISMIQUE]

Claude Froidevaux *In* ESA Definition of a European Program for Earthquake Prediction Res. Apr. 1979 p 17-18 refs In FRENCH (For primary document see N79-31865 22-46)

Avail: NTIS HC A05/MF A01

The conclusions of a working group coordinating the research of French laboratories on the problems of earthquake tectonics and earthquake generating processes in relation to seismic risk are presented. The outcome is an increased interest in the use of satellites in photographing the main buckling of the earth's crust, and to retransmit the data of seismological observatories. However, the necessity of including detailed ground studies by tectonic methods, providing analysis of active or recent geological

faults in terms of regional tectonic constraints is emphasized. These constraints should also be measured directly in order to get a quantitative understanding of intracontinental buckling.
Author (ESA)

N79-31870# Technische Universitaet, Darmstadt (West Germany). Inst. of Physical Geodesy.
APPLICATION OF GEODETIC TECHNIQUES IN EARTHQUAKE PREDICTIONS
Erwin Groten *In* ESA Definition of a European Program for Earthquake Prediction Res. Apr. 1979 p 19-20 refs (For primary document see N79-31865 22-46)
Avail: NTIS HC A05/MF A01

Various gravimetric techniques are proposed along with other geodetic techniques such as leveling and space techniques to supplement present geophysical methods of earthquake prediction. Geodetic methods seem to be advantageous in large scale studies. The exact regression of height variations with gravity variations in time provides an additional source of information besides dilatancy. Teleseismic approaches do not yet seem to have sufficient reliability and supplementary methods are still needed.
Author (ESA)

N79-31871# Technical Univ. of Istanbul (Turkey). Faculty of Earth Sciences.
AN ATTEMPT AT THE ELIMINATION OF NON-LOCAL CHANGES OF THE GEOMAGNETIC FIELD FOR EARTHQUAKE PREDICTION
A. Mete Isikara, N. Orbay, and M. Pantovic *In* ESA Definition of a European Program for Earthquake Prediction Res. Apr. 1979 p 21-25 refs Prepared in cooperation with Geomag. Inst., Grocka, Yugoslavia (For primary document see N79-31865 22-46)
Avail: NTIS HC A05/MF A01

Principal component analysis is applied to the comparison of horizontal, vertical, and total intensity moment values of the geomagnetic field together with sunspot numbers for four observatories in Balkan countries before and after the Bucarest earthquake (4 March 1977, M = 6.4). Assuming that the principal component best correlated with the solar activity can be associated with the external part, and consequently, the second one with the internal part of the variation of the field, it is suggested that it may be possible to eliminate non-local changes of the geomagnetic field. It is also suggested that from the ratio of the principal components, it may be possible to show changes in the geomagnetic field in relating to earthquakes without taking simple or weighted differences of the simultaneous measurements of the geomagnetic fields; and therefore, that this ratio can be accepted as an earthquake precursor.
Author (ESA)

N79-31872# Athens Univ. (Greece). Higher Geodesy and Cartography.
ON THE ERROR ANALYSIS OF GEODETICALLY DERIVED STRAINS IN SEISMIC ZONES
E. Livieratos *In* ESA Definition of a European Program for Earthquake Prediction Res. Apr. 1979 p 27-32 refs Prepared in cooperation with Triest Univ., Italy (For primary document see N79-31865 22-46)
Avail: NTIS HC A05/MF A01

The possibility of computing strain quantities in seismic zones by using geodetic methods and results is illustrated. The finite element method for the computation of the plane strain tensor concerning the displacements of a geodetic triangle is followed by an error analysis of the geodetically extracted strain rates with respect to the uncertainties of the geodetic results. An actual example of the importance and validity of the maximum shear strain computations at seismic zones shows the potentialities of the geodetic methods.
Author (ESA)

N79-31873# Trieste Univ. (Italy). Ist. di Geodesia Geofisica.
ON STRAIN AND TILT MEASUREMENT IN SEISMIC AREAS
C. Ebblin and M. Zadro *In* ESA Definition of a European Program for Earthquake Prediction Res. Apr. 1979 p 33-39 refs (For primary document see N79-31865 22-46)
Avail: NTIS HC A05/MF A01

Results given by tilt meters and strain meters installed in cavities in a seismic area can be usefully combined with those of fault-plane solutions provided that cavity effects are taken into account. A first approach is presented, using Fruili available data. It is concluded that the use of tilt and strain meters in seismic areas imply new views on experimental methodology. When enough instruments are available (a minimum of three strain meters and two tilt meters) all but one of the six tensor components of the strain can be determined, given the geometry of the cave.
Author (ESA)

N79-31874# Kiel Univ. (West Germany). Inst. fuer Geophysik.
EARTHQUAKE PREDICTION USING TILMETERS
J. Zschau *In* ESA Definition of a European Program for Earthquake Prediction Res. Apr. 1979 p 41-45 refs (For primary document see N79-31865 22-46)
Avail: NTIS HC A05/MF A01

Recent tilt measurements in tectonically active regions and model calculations on tilt anomalies for earthquakes prediction purposes are reviewed. Secular tilt changes, creep events in tilt, and tidal tilt amplitude modification prior to earthquakes are discussed. It is concluded that it is not at all clear whether secular tilt residuals so far observed prior to earthquakes are really precursory phenomena related to presiesmic crustal deformation or whether they are rather due to meteorological influences, especially rainfall. The importance of creep and tidal tilt measurements is emphasized.
Author (ESA)

N79-31875# Bureau de Recherches Geologiques et Minieres, Orleans (France).
ASSESSMENT OF EARTHQUAKE HAZARDS IN FRANCE WITH SPECIAL REFERENCE TO REMOTE SENSING DATA
C. Weber, J. Vogt, and G. Weecksteem *In* ESA Definition of a European Program for Earthquake Prediction Res. Apr. 1979 p 47-55 refs (For primary document see N79-31865 22-46)
Avail: NTIS HC A05/MF A01

Seismotectonic mapping is considered as the basis of analysis of seismic hazards and earthquake forecasting. It requires a correlation of a large range of data. The map prepared in France is the synthesis of six thematic maps (especially an instrumental, and macroseismic map), whose characteristics are given. However, emphasis is put on lineaments from satellite imagery, whose significance is discussed. They should be considered as an important element of a multidisciplinary approach to the evaluation of seismic hazards. Provided a given interpretation procedure is used, lineaments are an important contribution to solving neotectonic problems and to detecting possible active faults, especially when fair correlations with epicenters exist. A certain coherence already appears with the distribution of stress fields. These results encourage field controls and seismological monitoring.
Author (ESA)

N79-31876# Karlsruhe Univ. (West Germany). Inst. of Geophysics.
REAL-TIME MONITORING OF SEISMIC ACTIVITY AND EARTHQUAKE MECHANISMS IN THE RHINEGRABEN AREA AS A BASIS FOR PREDICTION
K.-P. Bonjer and K. Fuchs *In* ESA Definition of a European Program for Earthquake Prediction Res. Apr. 1979 p 57-62 refs (For primary document see N79-31865 22-46)
Avail: NTIS HC A05/MF A01

Although the level of seismic ectivity in the Rhinegraben area is not as high as in other active regions of the earth, destructive earthquakes do occur. Nearly all focal regions are characterized by microactivity. Real-time surveillance allows computer controlled positioning of sensitive mobile stations. Thus, high precision information about the seismic source regime may be obtained which is a necessary condition for the successful application of earthquake prediction techniques.
Author (ESA)

N79-31877# Commissariat a l'Energie Atomique, Montrouge (France). Lab. de Detection et de Geophysique.
AN EXAMPLE OF A SURVEILLANCE NETWORK FOR THE SEISMICITY OF A COUNTRY [UN EXEMPLE DE RESEAU DE SURVEILLANCE DE LA SISMICITE D'UN PAYS]
B. Massinon *In* ESA Definition of a European Program for Earthquake Prediction Res. Apr. 1979 p 63-64 In FRENCH (For primary document see N79-31865 22-46)

Avail: NTIS HC A05/MF A01

The French seismograph network, whose aim is the surveillance of the French territory and its immediate area, is briefly described. Established in 1961, this network includes 28 short-period seismic bases whose data are permanently transmitted to a data processing center located near Paris. The extension of such networks, which can give rapid information on occuring earthquakes, is called for and should be complemented by punctual studies of simulations of important events through the deployment of mobile stations. Author (ESA)

N79-31878# Eidgenoessische Technische Hochschule, Zurich (Switzerland). Inst. of Geophysics.

REAL-TIME ACQUISITION AND ANALYSIS OF DATA WITH THE SWISS STATION NETWORK SYSTEM

D. Mayer-Rosa and S. Mueller *In* ESA Definition of a European Program for Earthquake Prediction Res. Apr. 1979 p 65-66 (For primary document see N79-31865 22-46)

Avail: NTIS HC A05/MF A01

The Swiss seismic station network system is described as an equally distributed network of stations to be used as an effective tool for the rapid determination of source parameters for earthquakes, and to monitor the natural and induced seismic activity in the Alps as well as to detect regions with a potential for destructive earthquakes. The telemetry configuration of the network is described, and the central recording and analysis facilities in Zurich are detailed. For an effective data analysis a modern small computer is used together with microfilm and magnetic records, used for reading the P and S arrival times, maximum amplitudes, dominant frequency, and duration of signals. Author (ESA)

N79-31879# Academy of Sciences (USSR), Moscow. Inst. of Physics of the Earth.

PATTERN RECOGNITION IN EARTHQUAKE-BORNE AREAS IN ITALY

V. Keilis Borok, E. Oficerova, E. Ranzman, I. Rotwain, A. Solofjef, and A. Caputo (Rome Univ.) *In* ESA Definition of a European Problem for Earthquake Prediction Res. Apr. 1979 p 67-68 Submitted for publication (For primary document see N79-31865 22-46)

Avail: NTIS HC A05/MF A01

In accordance with the map of lineaments of the Italian region, the intersections of the lineaments where one may expect strong earthquakes to occur, were determined. The parameters used for the pattern recognition method are mostly based on elevation and slope. Many control experiments were made to test the validity and the stability of the results obtained. The results show several locations where strong earthquakes have not occured in historic times, and may occur in the future.

Author (ESA)

N79-31880# Geofizik Kuersuesue, Istanbul (Turkey).

THE EARTHQUAKE CATALOG OF TURKEY

H. Soysal *In* ESA Definition of a European Program for Earthquake Prediction Res. Apr. 1979 p 71-74 refs (For primary document see N79-31865 22-46)

Avail: NTIS HC A05/MF A01

The Development Project for the Historical Earthquake Catalog of Turkey and related sources are introduced and the characteristics of the catalog determined. As an example, Ottoman sources are given. Multidisciplinary characteristics of seismology and the necessity for the reorganization of the Republic of Turkey Prime Ministery Archives are pointed out. While discussing forecasting problems, the benefits of knowing how to reach a high level of confidence is considered and what tools are used. The important thing is to transfer this knowledge to social planners, politicians and the society. Author (ESA)

N79-31881# Naval Research Lab., Washington, D. C.

THE CURRENT CONVECTIVE INSTABILITY AND ITS APPLICATION TO DIFFUSE AURORAL SCINTILLATION CAUSING IRREGULARITIES

S. L. Ossakow and P. K. Chaturvedi 7 May 1979 18 p refs (AD-A069279; NRL-MR-3962) Avail: NTIS HC A02/MF A01 CSCL 04/1

A stable E x B gradient drift geometry can become destabilized by a current along the magnetic field. This type of instability is generically called the current convective instability. This instability may be responsible for the diffuse auroral scintillation causing F region irregularities observed by the DNA Wideband satellite. In these phenomena the northward TEC gradient dominated the altitude electron density gradient. We have investigated a simple plasma fluid model and found that instability results for certain cases. Author (GRA)

N79-31882# California Univ., Berkeley. Lawrence Berkeley Lab.

SIMULATION OF GEOCHEMICAL REACTIONS BY EQUILIBRIUM STEP CODES

C. L. Carnahan 1 Dec. 1978 19 p

(Contract EY-77-C-06-1030)

(RHO-BWI-C-37) Avail: NTIS HC A02/MF A01

The principles, applications, and limitations of the present state of the art of equilibrium step codes are described. The discussion is oriented toward concerns of the user of such codes, and toward application of the codes to study of low-temperature, aqueous, geochemical systems; detailed discussion of computational methods is avoided. DOE

N79-31883# California Univ., Livermore. Lawrence Livermore Lab.

SEISMIC MONITORING: A UNIFIED SYSTEM FOR RESEARCH AND VERIFICATIONS

L. Thigpen 6 Feb. 1979 44 p refs

(Contract W-7405-eng-48)

(UCRL-52665) Avail: NTIS HC A03/MF A01

A system for characterizing either a seismic source or geologic media from observational data was developed. This resulted from an examination of the forward and inverse problems of seismology. The system integrates many seismic monitoring research efforts into a single computational capability. Its main advantage is that it unifies computational and research efforts in seismic monitoring. DOE

N79-31884# California Univ., Livermore. Lawrence Livermore Lab.

COMPUTER CODE FOR THE TRANSFER FUNCTION OF SEISMIC SYSTEMS

K. Nakanishi 31 Jan. 1979 15 p refs

(Contract W-7405-eng-48)

(UCID-18071) Avail: NTIS HC A02/MF A01

A computer code was written to compute amplitude and phase transfer functions for various mechanical and electromagnetic seismic systems by use of analytical functions found in the literature. The program is used to compute transfer functions for the World-Wide Standard Seismic Network system, the Seismic Research Observatory system, the Lawrence Livermore Laboratory system, the Wischert system, the Wood-Anderson system, and other user specified systems. DOE

N79-31638# Graz Univ. (Austria). Dept. of Communications and Wave Propagation.

AUSTRIA'S SOUNDING ROCKET AND SCIENTIFIC BALLOON PROGRAM

W. Riedler *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 3-5 Sponsored by Austrian Solar and Space Agency (ASSA) (For primary document see N79-31637 22-42)

Avail: NTIS HC A23/MF A01

N79-31639# Centre National d'Etudes Spatiales, Paris (France).

THE FRENCH SOUNDING ROCKET AND BALLOON RESEARCH PROGRAM [PROGRAMME FRANCAIS DE RECHERCHE SPATIALE EN FUSEES-SONDES ET EN BALLONS]

J. P. Chassaing *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 11-14 refs In FRENCH (For primary document see N79-31637 22-42)

Avail: NTIS HC A23/MF A01

N79-31640# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Bereich fuer Projekttraegerschaften.

THE GERMAN SCIENTIFIC BALLOON AND SOUNDING

ROCKET PROJECTS
A. F. Dahl *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 15-26 (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

N79-31641# Royal Norwegian Council for Scientific and Industrial Research, Oslo. Space Activity Div.
THE NORWEGIAN SOUNDING ROCKET PROGRAM, 1978-1981
B. Landmark *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 31-34 (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

N79-31642# Instituto Nacional de Tecnica Aeroespacial, Esteban Terradas, Torrejon de Ardoz (Spain).
THE SPANISH NATIONAL BALLOON AND SOUNDING ROCKET PROGRAM
J. Casas and L. Pueyo (Comm. Nacl. de Investigacion del Espacio) *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 35-38 (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

N79-31643# Swedish Space Corp., Solna.
THE SWEDISH SOUNDING ROCKET PROGRAM
P. Zetterquist *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 39-41 (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

N79-31644# Appleton Lab., Slough (England).
REVIEW OF THE BRITISH SCIENTIFIC SOUNDING ROCKET AND BALLOON PROGRAMS
J. T. Delury *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 45-49 (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

N79-31645# Appleton Lab., Slough (England).
PARTICLE ACCELERATION, SPATIAL STRUCTURE, AND PULSATIONS IN THE AURORA
D. A. Bryant *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 53-55 refs (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

N79-31646# Mullard Space Science Lab., Dorking (England).
THE SPECTRUM OF AURORAL SUPRATHERMAL ELECTRONS
A. D. Johnstone *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 59-61 refs Sponsored by UK Sci. Res. Council (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

N79-31647# Max-Planck-Institut fuer Aeronomie, Katlenburg-Lindau (West Germany).
LOW-ENERGY AURORAL PARTICLE OBSERVATIONS
K. Wilhelm *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 63-71 refs (For primary document see N79-31637 22-42)
(Grants DFVLR-BPT-01-D1-123; DFVLR-WRK-274/3; DFVLR-BPT-01-D3-033)
Avail: NTIS HC A23/MF A01

N79-31648# Centre de Recherches en Physique de l'Environnement Terrestre et Planetaire, Orleans (France).
FRENCH MOBILE STATION FOR RECORDING GEOPHYSICAL DATA: DESCRIPTION; INITIAL RESULTS OF THE CONJUGATED CAMPAIGN IN ASSOCIATION WITH GEOS-1
S. Perraut, R. Gendrin, C. deVilledary, D. Fouassier (LGE, France), J. Lavergnat (LGE, France), J. P. Meunier (LGE, France), B. Morlet (LGE, France), F. Langeaud (CEPHAG, France), Y. Corcuff (LPHA, France), M. Tixier (LPHA, France) et al *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 73-84 refs Sponsored in cooperation with Inst. Natl. d'Astron. et de Geophys. and CNRS (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

N79-31650# Max-Planck-Institut fuer Aeronomie, Katlenburg-Lindau (West Germany).
STARE: A NEW POSSIBILITY FOR COORDINATED GROUND-BASED AND ROCKET RESEARCH IN NORTHERN SCANDINAVIA
R. A. Greenwald *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 95-103 refs (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

N79-31651# Max-Planck-Institut fuer Aeronomie, Katlenburg-Lindau (West Germany).
ROCKET EXPERIMENTS IN CONJUNCTION WITH THE IONOSPHERIC MODIFICATION EXPERIMENT IN NORTHERN NORWAY
P. Stubbe, H. Kopka, and G. Rose *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 108-111 refs (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

N79-31652# Technische Universitaet, Brunswick (West Germany). Inst. fuer Geophysik und Meteorologie.
INITIAL RESULTS OF THE SOUNDING ROCKET CAMPAIGN 'POLAR HIGH ATMOSPHERE'
B. Theile *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 114-118 refs Sponsored by Bundesmin. fuer Forsch. u. Technol. (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

N79-31654# Uppsala Ionospheric Observatory (Sweden).
PERTURBATIONS ASSOCIATED WITH A PLASMA RELEASE IN THE IONOSPHERE
G. Holmgren *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 121-122 refs Sponsored by Swed. Board for Space Activities (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

N79-31655# Kiruna Geophysical Inst. (Sweden).
SOME CHARACTERISTICS OF THE PARALLEL ELECTRIC FIELD ACCELERATION OF ELECTRONS OVER DISCRETE AURORAL ARCS AS OBSERVED FROM TWO ROCKET FLIGHTS
R. Lundin and I. Sandahl *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 125-136 (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

N79-31656# Swedish Space Corp., Solna.
SOUNDING ROCKET ACTIVITY IN EUROPE IN THE 1980'S
P. Zetterquist *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 137-147 refs (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

N79-31664# Bern Univ. (Switzerland). Physikalisches Inst.
TRENDS IN MIDDLE ATMOSPHERE RESEARCH
E. Kopp *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 197-207 refs (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

N79-31665# University Coll. of Wales, Aberystwyth.
THE WINTER ANOMALY IN RADIO-WAVE ABSORPTION
E. R. Williams *In* ESA European Sounding Rocket, Balloon

and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 209-214 refs (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

N79-31666# Stockholm Univ. (Sweden). Dept. of Meteorology.
SPECTROPHOTOMETRIC MEASURING TECHNIQUES FOR ATMOSPHERIC QUANTAL EMISSIONS
J. Stegman, P.-E. Tuninger, N. Wilhelm, and G. Witt *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 217-222 refs (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

N79-31667# Auroral Observatory, Tromso (Norway).
INTENSITY ENHANCEMENT ON THE WAVELENGTH OF THE HeI 5876 A EMISSION OBSERVED AT HIGH LATITUDE
K. Henriksen *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 223-234 refs (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

N79-31705# Centre d'Etude Spatiale des Rayonnements, Toulouse (France).
AURORAL INVESTIGATIONS BY BALLOON-BORNE OBSERVATORIES DURING THE SAMBO 1 CAMPAIGN
J. P. Treilhou, F. Cambou, I. A. Zhulin, and L. Lazutin *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 487-496 refs Prepared in cooperation with Acad. of Sci. (USSR), Moscow and Swed. Space Corp., Solna (For primary document see N79-31637 22-42)
(Contract CNES-73-150-212)
Avail: NTIS HC A23/MF A01

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N79-31885*# Texas A&M Univ., College Station.
CONVECTIVE RAINFALL ESTIMATION FROM DIGITAL GOES-1 INFRARED DATA
Gary L. Sickler and Aylmer H. Thompson Washington NASA Sep. 1979 96 p refs
(NASA-RP-1034) Avail: NTIS HC A05/MF A01 CSCL 04B

An investigation was conducted to determine the feasibility of developing and objective technique for estimating convective rainfall from digital GOES-1 infrared data. The study area was a 240 km by 240 km box centered on College Station, Texas (Texas A and M University). The Scofield and Oliver (1977) rainfall estimation scheme was adapted and used with the digital geostationary satellite data. The concept of enhancement curves with respect to rainfall approximation is discussed. Raingage rainfall analyses and satellite-derived rainfall estimation analyses were compared. The correlation for the station data pairs (observed versus estimated rainfall amounts) for the convective portion of the storm was 0.92. It was demonstrated that a fairly accurate objective rainfall technique using digital geostationary infrared satellite data is feasible. The rawinsonde and some synoptic data that were used in this investigation came from NASA's Atmospheric Variability Experiment, AVE 7. G.Y.

N79-31886# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
THE 19303A GSRS, MISSILE NUMBER 1154, ROUND NUMBER V-19
Mar. 1979 20 p
(DA Proj. 1T6-65702-D-126)
(AD-A070490; ECOM-DR-994) Avail: NTIS HC A02/MF A01 CSCL 04/2

Meteorological data gathered for the launching of 19303 A GSRS, Missile Number 1154, Round Number V-19, are presented in tabular form. Author (GRA)

N79-31887# Air Force Environmental Technical Applications Center, Scott AFB, Ill.
MCENTIRE ANG, COLUMBIA, SOUTH CAROLINA. REVISED UNIFORM SUMMARY OF SURFACE WEATHER OBSERVATIONS (RUSSWO) Final Report
11 Jan. 1979 468 p
(AD-A070152; USAFETAC/DS-79/020) Avail: NTIS HC A20/MF A01 CSCL 04/2

This report is a six-part statistical summary of surface weather observations for Mc Entire ANG, Columbia, South Carolina. It contains the following parts: (1) weather conditions, atmospheric phenomena, (2) precipitation, snowfall and snow depth daily amounts and extreme values, (3) surface winds, (4) ceiling versus visibility, sky cover, (5) psychrometric summaries daily maximum and minimum temperatures, extreme maximum and minimum temperatures, psychrometric summary of wet-bulb temperature depression versus dry-bulb temperature, means and standard deviations of dry-bulb wet-bulb and dew-point temperatures and relative humidity, and (6) pressure summary means, standard, deviations, and observation counts of station pressure and seal-level pressure. Data in this report are presented in tabular form, in most cases in percentage frequency of occurrence or cumulative percentage frequency of occurrence tables. Author (GRA)

N79-31888# California Univ., Livermore. Lawrence Livermore Lab.
OBJECTIVE WIND FIELD PATTERN CHARACTERIZATION
J. J. Walton and C. A. Sherman Aug. 1978 14 p refs Presented at 9th Meeting on Air Pollution Modeling and its Application, Toronto, Canada, 28 Aug. 1978
(Contract W-7405-eng-48)
(UCRL-80901; CONF-780841-1) Avail: NTIS HC A02/MF A01

The method of principal components analysis provides a basis for comparison of wind field patterns at different times and for generating typical patterns when similarities are identified. The method was used to produce wind fields to drive a transport-diffusion code. DOE

N79-31889# Brookhaven National Lab., Upton, N. Y.
ATMOSPHERIC TURBULENCE AND DIFFUSION
H. N. Lee 1979 7 p refs Presented at the 4th Symp. on Turbulence, Diffusion and Air Pollution, Reno, Nev., 15 Jan. 1979
(Contract EY-76-C-02-0016)
(BNL-25026; Conf-790101-8) Avail: NTIS HC A02/MF A01

The structures of lower atmospheric turbulent motion over nonhomogeneous low hill terrain were investigated by numerical integration of high order closure turbulence transport equations with momentum equations. The finite element numerical technique and model developed could be extended to a nonneutral case. The proposed dynamic formulation of the eddy viscosity coefficient is particularly attractive and provides a viable alternative approach to study the atmospheric turbulent motion and diffusion over a complicated irregular terrain. DOE

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N79-31890*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SPECTRAL MEASUREMENTS OF OCEAN-DUMPED WASTES TESTED IN THE MARINE UPWELLED SPECTRAL SIGNATURE LABORATORY
William G. Witte, J. W. Usry, Charles H. Whitlock, and E. A. Gurganus Washington Sep. 1979 34 p refs
(NASA-TP-1480; L-12906) Avail: NTIS HC A03/MF A01 CSCL 08C

Transmission and inherent upwelled radiance measurements were made of various mixtures of three ocean-dumped industrial

plant wastes in artificial seawater. Laboratory analyses were made of the physical and chemical properties of the various mixtures. These results and the laboratory measurements of beam attenuation and inherent upwelled radiance indicate a variety of chemical and spectral responses when industrial wastes are added to artificial seawater. In particular, increased levels of turbidity did not always cause increased levels of inherent reflectance. Author

N79-31891# Stanford Univ., Calif. Dept. of Geology.
SEDIMENTATION OF NEW OCEAN CRUST: THE MID-ATLANTIC RIDGE, 37 DEG N M.S. Thesis
Nancy Sharman Marks Jan. 1979 70 p refs
(Contract N00014-77-C-0390)
(AD-A068306) Avail: NTIS HC A04/MF A01 CSCL 08/7

A study of sediments from the FAMOUS area near 36 deg 50 min N lattitude on the Mid-Atlantic Ridge reveals a great range of physical, chemical, and biological parameters over a small area of the sea floor. Inside the rift valley, sediment cover patterns reflect asymmetrical spreading rates and general transport of sediments from topographic highs to low areas. A clear relationship between grain size and depth can be described by a simple linear function, with progressively finer sediments found at greater depths. The primary mechanism responsible for this distribution is thought to be gentle gravity transport of finer sediment fractions which are resuspended by bioturbation. Episodic processes, such as slumping, are believed to be less important to observed grain-size patterns than this slow but continuous process. Bottom currents are also active in the rift valley, but their primary effect is the localized formation of transient ripple and scour features. The CaCO3 content is anomalously low in rift valley sediments, probably because of dilution of calcareous sediments by volcanic debris. The high clay content in rift valley sediments suggests that this component is mainly very fine-grained. An examination of benthic foraminifera in the FAMOUS sediments reveals surprisingly high variablity. GRA

N79-31892# Skidaway Inst. of Oceanography, Savannah, Ga.
SOUTHEAST CONTINENTAL SHELF STUDIES
12 Feb. 1979 26 p refs
(Contract EY-76-S-09-0901)
(SRO-901-3) Avail: NTIS HC A03/MF A01

Research efforts on the southeast continental shelf currently describe the manner in which fluctuations in Gulf Stream motion influence biological and chemical processes. Current meter arrays are maintained in the Georgia Bight and in Onslow Bay to describe general circulation patterns and to identify forcing functions. Biological studies describe processes affecting temporal and spatial variations on the shelf and have attempted to track the biological history of intruded Gulf Stream water masses. Chemical studies examine the influence of both physical and biological variables on the distribution and fate of trace elements. The current state of knowledge is reviewed, the hypotheses developed are described, and a rationale for testing these hypotheses is given. DOE

N79-31893# Columbia Univ., Palisades, N.Y. Lamont-Doherty Geological Observatory.
TRANSPORT AND TRANSFER RATES IN THE WATERS OF THE CONTINENTAL SHELF Annual Report
P. E. Biscaye Jul. 1978 115 p refs
(Contract EY-76-W-02-2185)
(COO-2185-11) Avail: NTIS HC A06/MF A01

Using natural radioactive tracers the removal rates of reactive metals from the surface waters of the New York Bight were estimated and these ranged over an order of magnitude from most rapid nearshore to least rapid over the upper continental slope. Once removed nearshore, however, these tracers, and the pollutants for which they proxy, did not remain permanently in the sediments but appeared to be remobilized (probably by oxidation) during the winter and reintroduced into the water column. Hydrographic data on the structure of the water column resulted in a description of the system that is crucial to understanding geochemical and biological processes which affect pollutants. Hypotheses concerning the renewal of shelf water by direct exchange between shelf and upper slope water are discussed. DOE

N79-31894# Woods Hole Oceanographic Institution, Mass. Marine Policy and Ocean Management Program.
PROCEEDINGS OF A WORKSHOP ON COASTAL ZONE RESEARCH
David G. Aubrey Apr. 1979 121 p refs Workshop held at Woods Hole, Mass., 27-28 Nov. 1978
(Grant NOAA-04-M01-149)
(PB-295092/1; WHOI-79-40) Avail: NTIS HC A06/MF A01 CSCL 13B

The workshop brought together fifty researchers actively studying physical processes in the Massachusetts coastal zone. Summaries of the presentations are included. Two sets of recommendations evolved from the workshop. The first set recommends ways to facilitate scientist, user communication and provide more rapid dissemination of coastal research results. The second set describes areas of future research in the Massachusetts coastal zone. GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N79-31895*# National Aeronautics and Space Administration, Washington, D. C.
OBTAINING GROWTH HORMONE FROM CALF BLOOD
L. A. Kalchev, K. K. Ralchev, and I. T. Nikolov Aug. 1979 9 p refs Transl. into ENGLISH from Godishnik Sofiiskiya Univ. Biol. Fak. (Sofia), vol. 62, bk. 1, 1967-1968 p 175-181 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Dept. of Animal Physiol.
(Contract NASw-3199)
(NASA-TM-75326) Avail: NTIS HC A02/MF A01 CSCL 06C

The preparation of a growth hormone from human serum was used for the isolation of the hormone from calf serum. The preparation was biologically active - it increased the quantity of the free fatty acids released in rat plasma by 36.4 percent. Electrophoresis in Veronal buffer, ph 8.6, showed the presence of a single fraction having mobility intermediate between that of alpha and beta globulins. Gel filtration through Sephadex G 100 showed an elutriation curve identical to that obtained by the growth hormone prepared from pituitary glands. A.W.H.

N79-31896# Civil Aeromedical Inst., Oklahoma City, Okla.
EFFECTS OF PROPRANOLOL ON TIME OF USEFUL FUNCTION (TUF) IN RATS
E. A. Higgins, J. M. McKenzie, G. E. Funkhouser, and S. R. Mullen Mar. 1979 14 p refs
(AD-A068535/4; FAA-AM-79-10) Avail: NTIS HC A02/MF A01 CSCL 06/3

To assess the effects of propranolol on tolerance to rapid decompression, a series of experiments was conducted measuring time of useful function (TUF) in rats exposed to a rapid decompression profile in an altitude chamber. In other experiments TUF was measured for rats exposed to an oxygen/nitrogen gas mixture which produced a hypoxic condition equivalent to that in the decompression experiments. The findings were: (1) Rats become less tolerant to hypoxia of an onset rate comparable to that of rapid decompression when given propranolol, and this intolerance is further exacerbated by an increase in physical exertion. (2) Younger animals are more susceptible to this type of hypoxia, but propranolol has no greater effect on hypoxia tolerance in younger animals. (3) None of the reduced tolerance can be attributed to a shift in the oxyhemoglobin dissociation curve. In rats the curve is shifted slightly to the left, whereas, in man, there is a reported shift to the right. Author

N79-31897# California Univ., Irvine.
DIRECT EXPOSURE OF MONOLAYERS OF MAMMALIAN CELLS TO AIRBORNE POLLUTANTS IN A UNIQUE CULTURE SYSTEM Annual Progress Report, 1 Jun. 1977 - 31 May 1978
Ronald E. Rasmussen, T. Timothy Crocker, G. Scott Samuelson, M. E. Witte, and J. T. Taylor Aug. 1978 21 p ref
(Grant AF-AFOSR-3343-77)

(AD-A069822; AFOSR-79-0694TR; APR-1) Avail: NTIS HC A02/MF A01 CSCL 06/20

A 6-chamber system for the exposure of mammalian cells to pollutant gases has been assembled and tested. The system allows exposure of monolayers of cells to various concentrations of nitrogen dioxide and recovery of the cells for analysis. Capability for exposure to ozone and sulfur dioxide alone or in combination is being added to the system. Studies with cell lines derived from human and rodent respiratory tissue have shown that the cells are extremely sensitive to ihibition of cell replication at low levels of (nitrogen dioxide) (0.15 ppm) and ozone (0.05 - 0.08 ppm). This effect does not seem to be due to the solution of the gases in the growth medium but rather due to a direct effect on the cells. GRA

N79-31898# Utah Univ., Salt Lake City. Dept. of Biology.
ENERGY TRANSFER MECHANISMS IN PHOTOBIOLOGICAL REACTIONS Final Report, 1 Apr. 1960 - 31 Mar. 1979
John D. Spikes 31 Mar. 1979 21 p refs
(Contract EY-76-S-02-0875)
(COO-875-180) Avail: NTIS HC A02/MF A01

Steady-state kinetic studies, flash photolysis and spectral studies, and product formation studies of the sensitized photooxidation of the five susceptible amino acids (cycteine, histidine, methonine, tryptophan, and tyrosine) and their derivatives, as well as purines and pyrimidines were carried out. The mechanisms of the photodynamic inactivation of enzymes (trypsin, ribonuclease, lysozyme) were investigated. Mechanisms of photosensitization were also studied. DOE

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N79-31899# Committee on Government Operations (U. S. House).
RADIATION PROTECTION
Washington GPO 1978 568 p refs Hearings before a Subcomm. of the Comm. on Government Operations, 95th Congr., 2d Sess., 18-19 Apr., 13 Jul. 1978
(GPO-35-583) Avail: Comm. on Government Operations

The governmental structure which was created to deal with the problem of radiation, and which is charged with the protection of the public from the hazards of radiations is reviewed. In particular, the role of the Environmental Protection Agency in protecting the public from radiation hazards is examined. The agency is examined as to whether its authorities are clear, whether it has the necessary resources to carry out its mission, whether the administration is providing necessary support, and whether the other agencies are cooperating with it. G.Y.

N79-31900# National Academy of Sciences - National Research Council, Washington, D. C. Committee on Hearing Bioacoustics and Biomechanics.
THE EFFECTS OF WHOLE-BODY VIBRATION ON HEALTH
Mar. 1979 11 p refs
(Contract N00014-79-C-0060)
(AD-A068478) Avail: NTIS HC A02/MF A01 CSCL 06/16

For most common prolonged occupational exposures to whole-body vibration there appears to be little or no direct risk to health. However, it is possible that exposure could be annoying or painful and this could lead to functional alterations such as muscular weakness, high blood pressure, fatigue, or decreased nerve condition velocity. Exposure may also act to exacerbate existing disease states. Specific research guidelines are offered. GRA

N79-31901# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
MODELS AND ANALOGUES FOR THE EVALUATION OF HUMAN BIODYNAMIC RESPONSE, PERFORMANCE AND PROTECTION
H. E. Vongierke, ed. (AMRL) Jun. 1979 404 p refs In ENGLISH; partly in FRENCH Presented at the Aerospace Med. Panel's Specialists' Meeting, Paris, 6-10 Nov. 1978
(AGARD-CP-253; ISBN-92-835-0240-X) Avail: NTIS HC A18/MF A01

Whole body kinematic models for the prediction of body motion are considered as well as spinal models, head-neck models, and heat injury models for the prediction of internal stress and strain and injury probability under escape, crash, and windblast conditions. Cardiovascular models are included to describe and explain human response to sustained acceleration and air combat maneuvers. Biodynamic models interpreting physiological and performance response as well as human operator control capability in vibration and roll motion environments are also presented. Operational injury analyses as well as laboratory human and animal data are discussed as a basis for further model development and validation. Applications of the models include the prediction of body motions, physiological response and injury probability under biodynamic stress and the assistance in protective system, crashworthiness, and cockpit design. For individual titles, see N79-31902 through N79-31931.

N79-31902# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
PREDICTION OF WHOLE-BODY RESPONSE TO IMPACT FORCES IN FLIGHT ENVIRONMENTS
Ints Kaleps *In* AGARD Models and Analogues for the Evaluation of Human Biodyn. Response, Performance and Protect. Jun. 1979 14 p refs (For primary document see N79-31901 22-52)
Avail: NTIS HC A18/MF A01

The general predictive and structural properties of human body gross motion simulation models and their applicability to flight associated problems are discussed. A specific application of such a model is demonstrated by the simulation of human response to whole body-G sub x impact and the comparison of the results with experimentally observed human responses to the same dynamic exposures. The simulations were performed using the articulated total body (atb) computer model based on rigid body mechanics and possessing a number of internal and external force and constraint options to reflect resistive forces within human joints and to allow the interaction of external configurational elements. The predicted data of limb motions, their accelerations and forces generated in the harness restraint system are compared with those obtained experimentally from acceleration transducers on the head and chest of human test subjects. The model structure and its dynamic modeling capability, the general data input requirements, the specific set of data used for the -G sub x impact simulations, and some of the shortcomings and required improvements indicated by the simulation are discussed. J.M.S.

N79-31903# Dayton Univ. Research Inst., Ohio.
PROCEDURES USED TO GENERATE INPUT DATA SETS FOR THE ARTICULATED TOTAL BODY MODEL FROM ANTHROPOMETRIC DATA
Duane G. Leet *In* AGARD Models and Analogues for the Evaluation of Human Biodyn. Response, Performance and Protect. Jun. 1979 15 p refs (For primary document see N79-31901 22-52)
Avail: NTIS HC A18/MF A01

Computer software simulation techniques used to evaluate safety aspects of aircraft ejection are discussed with emphasis on generation of input data sets from anthropometric data to define body segments and motion. Body segment inertial data, joint locations, segment contact ellipsoids, and body and joint axes orientation are among the input data required on each segment. The techniques developed to generate these data sets are described. J.M.S.

N79-31904# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
CORRELATION OF MECHANISM OF EXTREMITY INJURY AND AERODYNAMIC FACTORS IN EJECTIONS FROM F-4 AIRCRAFT
Steven P. Combs *In* AGARD Models and Analogues for the Evaluation of Human Biodyn. Response, Performance and Protect. Jun. 1979 4 p refs (For primary document see N79-31901 22-52)
Avail: NTIS HC A18/MF A01

Extremity injuries incurred during the ejection sequence in

43 of 399 F-4 ejections were analyzed. Of the 43 ejections there were 95 extremity injuries. The injuries were divided into two groups: severe and minimal. Severe injuries consisted of fractures, dislocations, ligamentous tears and nerve palseys. There were 61 severe injuries. Minimal injuries consisted of contusions, lacerations, minor sprains. There were 34 minimal injuries. The 61 severe injuries were divided into 39 upper extremity injuries and 22 lower extremity injuries. The majority of the severe upper extremity injuries involved the proximal joints and the majority of the severe lower extremity injuries involved the distal joints. When the windblast/windflail injuries were compared to the various variables correlation was seen with the knots indicated airspeed, aircraft attitude, and aircraft type. The incident of extremity injury increases with increased airspeed, a nose down attitude, and decreases in the RF-4C aircraft configuration.
J.M.S.

N79-31905# Technische Hochschule, Darmstadt (West Germany). Inst. fuer Mechanik.

REFERENCE PARAMETERS FOR SHOCK INPUTS AND SHOCK TOLERANCE LIMITS

K. E. Meier-Doernberg *In* AGARD Models and Analogues for the Evaluation of Human Biodyn. Response, Performance and Protect. Jun. 1979 18 p refs (For primary document see N79-31901 22-52)
Avail: NTIS HC A18/MF A01

A data reduction technique based on control techniques and system analysis but adapted and extended for the purpose of single shock events in nonlinear systems is described. The major features of the method include evaluation and definition of system relevant input quantities and of input relevant system properties as reference parameters and uniform plotting of the various deduced shock data input values, exposure limits, safety requirements, test and design parameters, standard Fourier and response spectra in terms of the defined reference parameters. As examples, severity criteria, models, and methods which are used to describe head or whole body tolerance are compared with data by means of the established reference parameters in order to discuss their mechanical meaning and suitable range of application.
J.M.S.

N79-31906# Naval Aerospace Medical Research Lab., New Orleans, La.

MULTIAXIS DYNAMIC RESPONSE OF THE HUMAN HEAD AND NECK TO IMPACT ACCELERATION

C. L. Ewing, D. J. Thomas, and L. Lustick *In* AGARD Models and Analogues for the Evaluation of Human Biodyn. Response, Performance and Protect. Jun. 1979 27 p refs (For primary document see N79-31901 22-52)
Avail: NTIS HC A18/MF A01

The complete kinematic response of the head and the first thoracic vertebral body was measured over the range of variables required for human analog development during impact acceleration experiments. The relationships of the kinematic variables are graphically presented and statistically analyzed. A head and neck model for two dimensional response is evaluated. The approaches and constraints for a three dimensional model are evaluated. Anthropometric effects on the dynamic response are presented. The data base serves as a basis for the validation of human surrogate head and neck response to -X and +Y acceleration.
J.M.S.

N79-31907# Naval Aerospace Medical Research Lab., New Orleans, La.

TRANSIENT INTRAVENTRICULAR CONDUCTION DEFECTS OBSERVED DURING EXPERIMENTAL IMPACT IN HUMAN SUBJECTS

P. L. Majewski, T. J. Borgman, Jr., D. J. Thomas, and C. L. Ewing *In* AGARD Models and Analogues for the Evaluation of Human Biodyn. Response, Performance and Protect. Jun. 1979 11 p refs (For primary document see N79-31901 22-52)
Avail: NTIS HC A18/MF A01

Impact acceleration research utilizing normal human volunteer subjects and electrocardiographic monitoring is discussed. Four episodes of transient intraventricular conduction disturbances are presented and discussed relative to previous clinical and experimental investigations.
J.M.S.

N79-31908# Wayne State Univ., Detroit, Mich. Bioengineering Center.

SIMULATION OF HEAD AND NECK RESPONSE TO -G SUB x AND +G SUB z IMPACTS

A. I. King, S. S. Nakhla, and N. K. Mital *In* AGARD Models and Analogues for the Evaluation of Human Biodyn. Response, Performance and Protect. Jun. 1979 13 p refs (For primary document see N79-31901 22-52)
(Contract N00014-75-C-1015)
Avail: NTIS HC A18/MF A01

A two dimensional mathematical model of the spine was exercised to identify mechanisms of neck injury due to hyperflexion. Loss of pilots due to ditching at sea was one of the motivations for this study. It was found that helmets have the potential of increasing injury severity particularly during a combined +G sub z and -G sub x impact, with the pulses coincident in time. The four parameters that are potentially injurious are neck shear, chin-chest contact force, odontoid process excursion into the spinal canal and spinal cord stretch.
R.E.S.

N79-31909# Yale Univ., New Haven, Conn. Engineering Lab. for Musculoskeletal Diseases.

A THREE-DIMENSIONAL MATHEMATICAL ANALOGUE OF THE SPINE STRUCTURE: A COMPREHENSIVE APPROACH

Manohar M. Panjabi *In* AGARD Models and Analogues for the Evaluation of Human Biodyn. Response, Performance and Protect. Jun. 1979 10 p refs Sponsored in part by NIH (For primary document see N79-31901 22-52)
Avail: NTIS HC A18/MF A01

The human spine was viewed as a collection of functional spinal units, each unit consisting of two adjacent vertebrae and the interconnecting soft tissue. Mathematically this unit of the spine was modelled as two rigid bodies connected by a single deformable link. The latter was a three dimensional three element viscoelastic solid. Experimental techniques were developed which provide the physical properties of the human functional spinal units in three dimensional space. These properties incorporated into a three dimensional mathematical model provided, for the first time, a mathematical analog of the spine which was entirely based upon experimentally derived spine data.
R.E.S.

N79-31910# Northwestern Univ., Evanston, Ill. Dept. of Civil Engineering.

A THREE DIMENSIONAL DISCRETE ELEMENT DYNAMIC MODEL OF THE SPINE, HEAD AND TORSO

Ted Belytschko and Eberhart Privitzer *In* AGARD Models and Analogues for the Evaluation of Human Biodyn. Response, Performance and Protect. Jun. 1979 15 p refs Prepared in cooperation with Stanford Res. Inst., Menlo Park, Calif. (For primary document see N79-31901 22-52)
(Contracts F33615-76-C-0506; F33615-78-C-0523)
Avail: NTIS HC A18/MF A01

A three dimensional, discrete model of the human spine, head and torso is described. This model is an evolution of earlier discrete models which are reviewed and discussed. The anatomy was modeled by a collection of rigid bodies, which represent skeletal segments such as the vertebrae, pelvis, and ribs, interconnected by deformable elements, which represent ligaments, cartilagenous joints, viscera and connective tissues. The model was validated by comparing its impedance to measurements on human volunteers. The principal feature of this model is the generality of its formulation which enables it to be applied to a wide variety of impact situations. Simulations are reported for a vertical ejection, a pre-ejection alignment and bird impact on a canopy. A postprocessor was developed which interprets the complex time history output in terms of injury potential.
R.E.S.

N79-31911# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.

APPLICATION OF BIODYNAMIC MODELS TO THE ANALYSIS OF F-16 CANOPY BIRDSTRIKE

Lawrence J. Specker, Norman S. Phillips (Dayton Univ. Res. Inst.), and James W. Brinkley *In* AGARD Models and Analogues for the Evaluation of Human Biodyn. Response, Performance and Protect. Jun. 1979 12 p refs (For primary document see N79-31901 22-52)

Avail: NTIS HC A18/MF A01

High speed film data were analyzed from F-16 birdstrike tests to quantitatively define the deflection motion as a function of the initial test conditions. Crewmember position studies indicated probable head contact with the canopy surface during birdstrike at comfortable seating positions. Helmet size and crewmember size were shown to have a negligible effect on increasing clearance between helmet and canopy. A specially instrumented head-neck apparatus was designed and used in the tests to measure the accelerations of the head and the impact forces and moments at the head and neck. The acceleration data from the head-neck test apparatus were used as input to a head injury severity prediction model to determine the level of injury sustained by the pilot. The force data were compared to known injury force levels. A second approach involved the use of the photometric data to describe the response shape and velocity of the canopy and inertial properties associated with the impact as a driving input to a computer model of the helmeted crewman to further evaluate the crewman response to birdstrike. Author

N79-31912# Strathclyde Univ., Glasgow (Scotland). Bioengineering Unit.

A FAILURE CRITERION FOR HUMAN, VERTEBRAL, CANCELLOUS BONE

M. J. Pearcy and J. H. Evans *In* AGARD Models and Analogues for the Evaluation of Human Biodyn. Response, Performance and Protect. Jun. 1979 7 p refs (For primary document see N79-31901 22-52)

Avail: NTIS HC A18/MF A01

In order to define a realistic criterion of failure, the compression and shear characteristics of human, vertebral, cancellous bone were investigated. To produce shear, torsion tests were used and the atmospheric environment during the tests was controlled to simulate physiological conditions. A rational mathematical characterization of the bone was developed to enable a realistic failure criterion to be established, encompassing the large biological variation of the results. The mechanical characteristics of the bone are complex but an elementary consideration of anisotropy led to a characterization that would appear to be sufficient. R.E.S.

N79-31913# Royal Air Force, Halton (England). Inst. of Pathology and Tropical Medicine.

INJURY MECHANISMS ANALYSIS IN AIRCRAFT ACCIDENTS

I. R. Hill *In* AGARD Models and Analogues for the Evaluation of Human Biodyn. Response, Performance and Protect. Jun. 1979 10 p refs (For primary document see N79-31901 22-52)

Avail: NTIS HC A18/MF A01

An analysis of 30 fatal aircraft accidents, some of which were survivable shows that the basic mechanisms of injury are common to many different accidents. From the investigation the following conclusions can be made: (1) serious or fatal head injury is the single most serious problem in aircraft accidents, particularly in light aircraft; (2) there is a wide margin in injury severity between survivors and fatalities; (3) restraint systems are still inadequate, especially for passengers; (4) the severity of injury is increased by: (a) 'ejection' from the aircraft, (b) severe damage to the airframe, (c) poor design features such as badly sited fuel tanks; (5) the principle method of serious injury is forward flexion over a lap belt; and (6) mathematical scoring of injuries makes more accurate analysis of accidents a feasible proposition. R.E.S.

N79-31914# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio. Biodynamics and Bioengineering Div.

THE VALIDATION OF BIODYNAMIC MODELS

Leon E. Kazarian and Henning E. vonGierke *In* AGARD Models and Analogues for the Evaluation of Human Biodyn. Response, Performance and Protect. Jun. 1979 14 p refs (For primary document see N79-31901 22-52)

Avail: NTIS HC A18/MF A01

The biological data required for developing and validating an axial musculoskeletal computer model of subhuman primates that in turn can be used to support the validation of a human response model and assist in predicting human tolerance is presented. Comparisons are made between the various validation approaches. The shortcomings and advantages of the various types of biodynamic data presently collected and available are delineated. Comparative whole body primate spinal impact tolerance curves are presented. Some physical constants for subhuman primate tissue are given, and areas where additional data are required to validate a subhuman primate model are identified. M.M.M.

N79-31915# Kentucky Univ., Lexington.

FREQUENCY RESPONSE OF CARDIOVASCULAR REGULATION IN CANINES TO SINUSOIDAL ACCELERATION AT FREQUENCIES BELOW 1 Hz (BASIS FOR BIODYNAMIC MODELING)

C. F. Knapp, J. A. Marquis, J. M. Evans, and D. R. Randall *In* AGARD Models and Analogues for the Evaluation of Human Biodyn. Response, Performance and Protect. Jun. 1979 17 p refs (For primary document see N79-31901 22-52)

(Contract F44620-74-C-0012)

Avail: NTIS HC A18/MF A01

Sinusiodal, whole body acceleration was used as a noninvasive forcing function to the cardiovascular system of unanesthetized, chronically instrumented canines to determine the low frequency (less than 1 Hz) dynamics of integrated barostatic cardiovascular regulation. Aortic pressure and flow, right and left ventricular pressure, heart rate and spinal axis acceleration were digitally sampled and filtered. The filtered data were then Fourier analyzed. The participation of neurally-mediated cardiac and vascular baroreflex mechanisms in the overall response was evaluated by comparing the subjects' response in a reflexive and nonreflexive condition. Transfer functions were then derived to describe the passive acceleration-induced intravascular pressure distrubances and the control action of the major baroreflex mechanisms. The dynamic (oscillatory) frequency response of the major cardiac and vascular baroreflex mechanisms was found to be limited primarily to the frequency range below 0.10 Hz. A comparison of the participation of cardiac and vascular mechanisms in the overall responses indicated that barostatic control is achieved principally via the systemic vascular mechanisms below 0.02 Hz, via the cardiac mechanisms from 0.04 to 0.10 Hz, and by the combined action of the two between 0.02 and 0.04 Hz. M.M.M.

N79-31916# School of Aerospace Medicine, Brooks AFB, Tex. Biodynamics Branch.

MATHEMATICAL MODELING OF ARTERIAL OXYGEN SATURATION AND EYE-LEVEL BLOOD PRESSURE DURING +G SUB Z STRESS

Kent K. Gillingham and Richard C. McNee *In* AGARD Models and Analogues for the Evaluation of Human Biodyn. Response, Performance and Protect. Jun. 1979 7 p refs (For primary document see N79-31901 22-52)

Avail: NTIS HC A18/MF A01

Mathematical descriptions of the dynamics of human arterial oxygen saturation (SaO2) and eye-level arterial blood pressure (ELBP) under conditions of varying +G sub Z stress were obtained by Fourier analysis. Simulated aerial combat maneuvering (SACM) G-stress profiles and the resulting physiologic responses to the G stress provided input-output data from which transfer functions were derived. Ensemble averaging of single-run transfer functions generated enhanced empirical G-to-SaO2 and G-to-ELBP transfer functions, which were approximated by various synthetic functions. Examination of predictive abilities of the empirical and synthetic transfer functions was accomplished by comparison of predicted and mean actual responses to SACM and nonSACM G-stress profiles. Author

N79-31917# Missouri Univ. -Rolla.

UNSTEADY-STATE RESPONSE OF THE VASCULAR SYSTEM TO TRANSIENT AND SUSTAINED AEROSPACE ACCELERATION PROFILES

Xavier J. R. Avula and Hans L. Oestreicher *In* AGARD Models and Analogues for the Evaluation of Human Biodyn. Response, Performance and Protect. Jun. 1979 9 p refs Prepared in cooperation with AMRL (For primary document see N79-31901 22-52)

Avail: NTIS HC A18/MF A01

A mathematical method to determine the response of the blood vessels to transient and sustained acceleration forces is presented. The method is based on coupling of the Navier-Stokes equations for blood flow and the large elastic deformation

theory for the deformation of the blood vessels, and solving them numerically under the appropriate initial and boundary conditions. A mathematical reasoning to neglect the effect of acceleration on microcirculation per se is given. However, microcirculation is indirectly affected by acceleration forces which tend to pool blood and bring about pressure changes in large vessels. Aortic pressures are calculated for examples of monotonically increasing and transient -G sub Z acceleration profiles, and one of the solutions is compared with an available, experimentally measured pressure from an animal experiment. In the absence of proper physiological scaling laws, the qualitative agreement between the theory and experiment is satisfactory.
M.M.M.

N79-31918# Naval Civil Engineering Lab., Port Hueneme, Calif.
A HEAD INJURY MODEL
Carley Ward *In* AGARD Models and Analogues for the Evaluation of Human Biodyn. Response, Performance and Protect. Jun. 1979 12 p refs (For primary document see N79-31901 22-52) (Contract DOT-HS-5-01132)
Avail: NTIS HC A18/MF A01

The history of analytical head injury modeling is briefly reviewed, and the design restrictions that limit their usefulness are discussed. One of the most recent models, a linear finite element idealization of the human brain, is presented. Intracranial pressures computed by this model are compared to pressures measured in human cadaver head impact tests. The computed pressures and observed injuries are correlated for a series of ten tests. Injury prediction based on maximum intracranial pressure is compared to prediction based on the Gadd Severity Index and the Head Injury Criterion Index. It was concluded that adequate padding of possible head impact surfaces and helmets could be very effective in preventing the type of injury observed in these tests. Such padding would eliminate the high-magnitude, impulsive-type head accelerations that produce high-magnitude pressure pulses in the brain.
M.M.M.

N79-31919# Rehabilitationsklinik Loipl, Bischofswiesen-Berchtesgaden (West Germany).
POTENTIAL RELATIONSHIP BETWEEN HUMAN CENTRAL NERVOUS SYSTEM INJURY AND IMPACT FORCES BASED ON PRIMATE STUDIES
F. Unterharnscheidt and C. L. Ewing *In* AGARD Models and Analogues for the Evaluation of Human Biodyn. Response, Performance and Protect. Jun. 1979 8 p refs Prepared in cooperation with Naval Aerospace Med. Res. Lab., New Orleans (For primary document see N79-31901 22-52)
Avail: NTIS HC A18/MF A01

Different species of monkeys underwent impact acceleration forces delivered to the head and neck by three different mechanisms. The first applied linear impact forces directly to the calvarium of the animal approximately through the center of gravity of the head resulting primarily in translational motion and deformation of the calvarium. The second mechanism applied angular impact forces directly to the calvarium by a device molded to the calvarium which forces the head through 45 degrees of forward flexion. The third mechanism applied impact forces indirectly to the head and neck by acceleration of the entire animal using a pelvic-torso restraint in which the head and neck were unrestrained. Low level, no injury experiments to high level, fatal injury experiments were accomplished by each mechanism.
G.Y.

N79-31920# Army Aeromedical Research Lab., Fort Rucker, Ala. Bioengineering and Life Support Equipment Div.
CORRELATION OF HEAD INJURY WITH MECHANICAL FORCES BASED ON HELMET DAMAGE DUPLICATION
Bruce Slobodnik *In* AGARD Models and Analogues for the Evaluation of Human Biodyn. Response, Performance and Protect. Jun. 1979 12 p refs (For primary document see N79-31901 22-52)
Avail: NTIS HC A18/MF A01

Human tolerance to head impact was assessed by correlating the force levels required to duplicate damage seen in 14 SPH-4 aviator helmets retrieved from US Army helicopter crashes with resulting head injury. The data obtained were used to validate the following: (1) the Wayne State University Concussive Tolerance Curve; (2) the Severity Index value of 1500 currently used in the US by the National Operating Committee on Standards for Athletic Equipment as the concussive threshold for helmeted head impacts; (3) the Head Injury Criterion value of 1000 currently used in the US by the Department of Transportation in occupant crash protection tests as the concussive threshold for impacts to the unprotected head; (4) the peak acceleration value of 400 G currently used by the US Army in evaluating aircrew protective headgear as the survivable limit; and (5) the peak transmitted force value of 5000 lb currently specified in British Standard 2495 as the survivable limit for helmeted head impacts.
G.Y.

N79-31921# Naval Aerospace Medical Research Lab., New Orleans, La.
THE EFFECT OF IMPACT ACCELERATION ON THE ELECTRICAL ACTIVITY OF THE BRAIN
Marc S. Weiss and Michel D. Berger *In* AGARD Models and Analogues for the Evaluation of Human Biodyn. Response, Performance and Protect. Jun. 1979 9 p (For primary document see N79-31901 22-52)
Avail: NTIS HC A18/MF A01

In a series of pilot experiments, eight Macaca Mulatta with chronically implanted cortical recording electrodes were tested using a range of -X impact accelerations. Both EEG and somatosensory evoked potential (SEP) data were collected and analyzed. The results suggest that for the peak acceleration levels used (281 m/sq s to 1550 m/sq s) the SEP is a more sensitive index of the inertial load on the brain than is the EEG. In particular, the duration of changes in shape of the early part (less than 100 ms latency) of the SEP is monotonically related to the peak sled acceleration. This has important implications for the physiological monitoring of human subjects in impact acceleration experiments.
G.Y.

N79-31922# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.
A HUMAN BODY AND CREW STATION MODELLING SYSTEM FOR MOTION STUDIES
George D. Frisch (Naval Aerospace Medical Research Lab., New Orleans) *In* AGARD Models and Analogues for the Evaluation of Human Biodyn. Response, Performance and Protect. Jun. 1979 13 p refs (For primary document see N79-31901 22-52)
Avail: NTIS HC A18/MF A01

The need to visualize and interpret human body movement data from experiments and simulations led to the development of a computerized, three dimensional representation of the human body and crew station. Particular emphasis was placed on head and neck motion within the confines of the A7E, LAMPS H2, and F18 crew stations, although the program is general enough to accomodate any geometrical configuration. There are numerous computer programs for the analysis or simulation of human movement in various environments, but perhaps the only common feature of all these systems is that they produce motion data to manipulate some skeletal model of the human body. Dissatisfaction with existing body models and stick figure displays led to the development of a human and crew station model for the computer with distinct advantages in display realism, movement definition, collision or interaction detection and cost-effectiveness in a real-time animation play-back environment.
G.Y.

N79-31923# Army Aviation Research and Development Command, Fort Eustis, Va.
THE USE OF MATHEMATICAL MODELING IN CRASHWORTHY HELICOPTER SEATING SYSTEMS
George T. Singley, III and Joseph L. Haley *In* AGARD Models and Analogues for the Evaluation of Human Biodyn. Response, Performance and Protect. Jun. 1979 21 p refs Prepared in cooperation with Army Aeromed. Res. Lab., Fort Rucker, Ala. (For primary document see N79-31901 22-52)
Avail: NTIS HC A18/MF A01

Crashworthy helicopter accident data revealing injury types related to seat design, seat occupant injury criteria, recent crashworthy seat test data, and crashworthy seat/occupant modeling technology are discussed. The designer's dilemma in finding the minimum injury solution by designing to the many conflicting variables is presented. The relationship between the spinal vertebra stress-strain characteristics and irreversible injury is discussed.
G.Y.

N79-31924# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany).
MAN, DUMMY, TEST VEHICLE: A COMPARISON OF TEST RESULTS FOR ESCAPE SYSTEMS WITH THE 3 DIFFERENT TEST METHODS
H.-D. Melzig, E. A. Bockemueller, and U. Schmidt *In* AGARD Models and Analogues for the Evaluation of Human Biodyn. Response, Performance and Protect. Jun. 1979 8 p ref (For primary document see N79-31901 22-52)
Avail: NTIS HC A18/MF A01

To prove the validity of experimental results gained with dummies or test vehicles for the qualification of man carrying parachutes, series of tests were conducted with parachute jumpers and their 2 analogues: rubber torso dummies and bomb shaped test vehicles. The results for the maximum filling force (opening shock) show significant differences, with highest values for the test vehicle, 75% less for the rubber dummy and an additional 75% less for the man. G.Y.

N79-31925# Centre d'Essais en Vol, Bretigny-sur-Orge (France).
TENTATIVE ESTIMATION OF THE INJURIES LIKELY TO OCCUR DURING THE CRASH OF A SA 341 GAZELLE HELICOPTER, FROM A STUDY ON MANNEQUINS [TENTATIVE D'ESTIMATION DES LESIONS POUVANT SURVENIR AU COURS D'UN CRASH D'HELICOPTERE GAZELLE SA 341 A PARTIR D'UNE ETUDE SUR MANNEQUINS]
B. Vettes and R. Eckert *In* AGARD Models and Analogues for the Evaluation of Human Biodyn. Response, Performance and Protect. Jun. 1979 19 p refs In FRENCH (For primary document see N79-31901 22-52)
Avail: NTIS HC A18/MF A01

An SA 341 Gazelle helicopter was released to the ground with equal horizontal and vertical speeds in order to estimate the chances of survival of the occupants, to improve the resistance of the structure, and to construct a mathematical model of an anticrash structure. Besides the different instruments fixed on the structures, three anthropometric dummies, clothed to represent the pilot, the copilot, and a passenger, were installed and equipped with accelerometers in the head, thorax, and pelvis. A constraint gauge was placed in the dorsal-lumbar region of the pilot. Structural damage was appraised at impact. The acceleration undergone by the occupants was given in intensity curves as a function of time. The most important accelerations are on the Z axis and are between 25 g and 30 g for durations on the order of 20 ms with a mean jolt of 1000 g/s and a vertebral compression of almost 400 daV. Accelerations along the X axis do not exceed 15 g. Injuries to the occupants are localized in the dorsal-lumbar region. Because of lack of data, the injuries eventually inflicted on the low cervical column (C5 to C7) by the rabbit punch are not completely known. Transl. by A.R.H.

N79-31926# Royal Aircraft Establishment, Farnborough (England). Human Engineering Div.
THE USE OF SPINAL ANALOGUE TO COMPARE HUMAN TOLERANCE OF REPEATED SHOCKS WITH TOLERANCE OF VIBRATION, PART 1
Geof Allen *In* AGARD Models and Analogues for the Evaluation of Human Biodyn. Response, Performance and Protect. Jun. 1979 15 p refs (For primary document see N79-31901 22-52)
Avail: NTIS HC A18/MF A01

A method is evolved for comparing theoretically the compatibility between ISO 2631 limits for human tolerance of vertical vibration and recent proposals for limits of tolerance of repeated shocks based on a spinal analogue. The method is applied both limits over a wide range of conditions, including a proposal for the maximum acceptable vibration crest factor to be increased from the present value of 3, to 6. Previous work on biodynamic modelling is briefly reviewed in relation to its application to standards for human tolerance of vibration and shock. G.Y.

N79-31927# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Bonn (West Germany). Inst. of Aviation Medicine.
THE RESPONSE OF A REALISTIC COMPUTER MODEL FOR SITTING HUMANS TO DIFFERENT TYPES OF SHOCKS
H. Mertens and L. Vogt *In* AGARD Models and Analogues for the Evaluation of Human Biodyn. Response, Performance and Protect. Jun. 1979 17 p refs (For primary document see N79-31901 22-52)
Avail: NTIS HC A18/MF A01

A mechanical model of the human body in the sitting posture is described. The model parameters were derived from the results of steady state vibration experiments conducted under various levels of static acceleration up to +4 Gz. The resulting nonlinear behavior of the human body was modeled by calculating the characteristics of the model elements. To investigate the model's response under impact loads, the characteristics of the elements were extrapolated beyond 4 G. The model was exercised with different input pulse shapes and the resulting forces and mass displacements were calculated. G.Y.

N79-31928# Naval Air Development Center, Warminster, Pa. Life Sciences Div.
SOME HUMAN RESPONSES TO REPEATED +G SUB z PULSES
Edwin Hendler and David C. Johanson *In* AGARD Models and Analogues for the Evaluation of Human Biodyn. Response, Performance and Protect. Jun. 1979 17 p refs (For primary document see N79-31901 22-52)
Avail: NTIS HC A18/MF A01

Six unprotected and relaxed subjects were exposed to haversine-shaped acceleration pulses while seated upright in a centrifuge and simultaneously performing a continuous tracking task and a discrete visual-motor response-time task. Twenty-five different acceleration pulses were used. Each subject made 5 successive runs a day, with each run containing a different acceleration pulse; each week of 5 test days therefore included all 25 pulses. From the data collected, relationships were explored between the dependent variables (mean heart rate (MHR), mean respiration rate (MRR), mean tracking error (MTE), and mean response time (MRT)) with pulse level (G sub z) and plateau duration (t) for the entire runs and for the individual phases of runs. Multiple regression equations were derived relating MHR and MTE to both G sub z and t. Correlations between dependent variables were calculated, as were measures of relative variability. G.Y.

N79-31929# Southampton Univ. (England). Inst. of Sound and Vibration Research.
THE BIODYNAMIC RESPONSE OF THE HUMAN BODY AND ITS APPLICATION TO STANDARDS
Michael J. Griffin, Christopher H. Lewis, Kenneth C. Parsons, and Eleri M. Whitham *In* AGARD Models and Analogues for the Evaluation of Human Biodyn. Response, Performance and Protect. Jun. 1979 18 p refs (For primary document see N79-31901 22-52)
Avail: NTIS HC A18/MF A01

The results of five experiments with groups of up to one hundred-and-twelve subjects and ten experiments with a single subject. The experiments were designed to investigate factors that affect the transmission of vertical (z-axis) vibration to the head over the frequency range 1 to 100 Hz. The distributions of response within subject groups were determined as a function of vibration frequency and it was found that subject weight affected seat-to-head transmissibility. There were differences in transmissibility between men and women and between men and boys. Changes in subject posture had a large affect on transmissibility. The effects of changes in muscle tension, head and foot position were also studied and methods of determining transmissibility with discrete sine, swept sine and random vibration inputs were compared. It was found that seat configuration greatly affected the transmission of vibration to the head. The experimental results are considered in the context of the possible development of standards on the biodynamic response of the body. G.Y.

N79-31930# Systems Technology, Inc., Hawthorne, Calif.
PROGRESS IN MEASURING AND MODELING THE EFFECTS OF LOW FREQUENCY VIBRATION ON PERFORMANCE
Henry R. Jex and Raymond E. Magdaleno *In* AGARD Models and Analogues for the Evaluation of Human Biodyn. Response, Performance and Protect. Jun. 1979 11 p refs Sponsored in part by the Air Force and Navy (For primary document see N79-31901 22-52)
Avail: NTIS HC A18/MF A01

Several facets of the comprehensive biodynamic modeling

program presented at the AGARD Aerospace Medical Panel Meeting at Oslo, 1974, were successfully completed and are reported. The development of a variety of lumped parameter models to explain and codify the known data on low-frequency vibration effects and to predict likely effects in new situations was brought to a useful level. The relationship and applications of these and other related models are discussed with respect to their development status and potential applications. Specific recommendations are made for more refined experimental data (e.g., simultaneous accelerations on various body locations and better postural and dynamic mode shapes via cinematography, etc.) and interface compatibility among various models. G.Y.

N79-31931# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
THE APPLICATION OF CONTROL THEORY TO THE INVESTIGATION OF ROLL MOTION EFFECTS ON HUMAN OPERATOR PERFORMANCE
A. M. Junker and W. H. Levison *In* AGARD Models and Analogues for the Evaluation of Human Biodyn. Response, Performance and Protect. Jun. 1979 9 p refs Prepared in cooperation with Bolt, Beranek, and Newman, Inc., Cambridge, Mass. (For primary document see N79-31901 22-52)
Avail: NTIS HC A18/MF A01

The application of manual control theory to the investigation of the effects of motion cues on pilot control behavior is presented. Experiments and modeling approaches which have led to the development of a predictive motion sensitive optimal-control pilot-vehicle model for roll axis motion cues are described. The way in which human operators make use of disturbance and commanded motion cues are also deliniated. Author

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N79-31932*# Texas Univ. at Austin.
MAKING IT IN ACADEMIC PSYCHOLOGY: DEMOGRAPHIC AND PERSONALITY CORRELATES OF EMINENCE
Robert L. Helmreich, Janet T. Spence, William E. Beane (Indiana Univ. at South Bend), G. William Lucker (Michigan Univ., Ann Arbor), and Karen A. Matthews (Pittsburgh Univ.) [1979] 56 p refs
(Grants NsG-2065; NSF BNS-78-08911)
(NASA-CR-162287) Avail: NTIS HC A04/MF A01 CSCL 05J

Citations to published work, personality, and demographic characteristics were examined in a sample of male and female academic psychologists. A large sex difference was found in citations with men receiving significantly more recognition. Reputational rankings of graduate school and current institution were significantly related to citations, as were components of achievement motivation. Mastery and work needs were positively related to citations while competitiveness was negatively associated with the criterion. A model of attainment in psychology is proposed and possible explanations for the differential recognition of women are explored. Author

N79-31933# Naval Postgraduate School, Monterey, Calif.
EFFECTS ON A-6E BOMBARDIER/NAVIGATOR FLIGHT TRAINING WITH THE INTRODUCTION OF DEVICE 2F114, A-6E WEAPON SYSTEM TRAINER M.S. Thesis
John Richard Tindle Mar. 1979 85 p refs
(AD-A068607) Avail: NTIS HC A05/MF A01 CSCL 05/9

As weapon systems grow increasingly complex and sophisticated, the training requirements for operator personnel become correspondingly more demanding. This increase in training requirements, coupled with increased operational costs, necessitates the use of simulators as an integral part of many training programs. With the introduction of device 2F114, A-6E Weapon System Trainer, the A-6 community will have a state-of-the-art simulator to employ in their training programs. Along with new devices, training programs must become more responsive to factors influencing training effectiveness and transfer of training. This report explores factors influencing simulator training effectiveness, and compares them with factors incorporated in device 2F114 and proposed training syllabi. Appendix B, 'Alternatives in Bombardier/Navigator Training,' identifies syllabus flights that have the potential to be substituted by the A-6E Weapon System Trainer. GRA

N79-31934# Air Force Human Resources Lab., Brooks AFB, Tex.
ADVANCED TRAINING FEATURES: BRIDGING THE GAP BETWEEN IN-FLIGHT AND SIMULATOR-BASED MODELS OF FLYING TRAINING Interim Report, Feb. - May 1978
Ronald G. Hughes Mar. 1979 19 p refs
(AF Proj. 1123)
(AD-A068142; AFHRL-TR-78-96) Avail: NTIS HC A02/MF A01 CSCL 05/9

An overview of advanced training features in flying training simulation is presented as well as a conceptual framework for distinguishing between enabling and instructional features. Reported shortcomings in the training of simulator instructor/operator personnel are seen as resulting in part from the rapid transition from in-flight to simulator-based training and in part from the absence of a behavioral conceptualization of the flying task itself. It is suggested that the area in which the flight simulator may be most effectively exploited lies in its capability for allowing the instructor to alter the basic structure of the task itself for the purpose of applying recognized learning principles and methods. Data on the effective application of backward chaining to a 30 degree dive bombing task are presented. GRA

N79-31935# Navy Personnel Research and Development Center, San Diego, Calif.
HEMISPHERIC ASYMMETRY AS RELATED TO PILOT AND RADAR INTERCEPT OFFICER PERFORMANCE Interim Report, Jun. 1976 - Jun. 1977
Gregory W. Lewis and Bernard Rimland Mar. 1979 32 p refs
(ZF61512001)
(AD-A068087; NPRDC-TR-79-13) Avail: NTIS HC A03/MF A01 CSCL 05/10

This report describes the application of a relatively new technology, the visual evoked potential (VEP) method of brain wave analysis, as a possible means of improving the prediction of performance in an area that has proven intractable to more conventional testing procedures--the military aviator. The subjects were 28 pilots and 30 radar intercept officers (RIOs) assigned to a Navy Readiness Training Squadron. VEP data were obtained from eight scalp electrode sites for each aviator. Ratings by the operations officer served as the criterion of performance. It was hypothesized that: (1) VEP amplitude differences would be found between the pilot and RIO groups, and (2) within the pilot and RIO groups, individual performance ratings would be related to VEP hemispheric asymmetry (amplitude differences between the right and left hemispheres). GRA

N79-31936# Johns Hopkins Univ., Baltimore, Md. Div. of Behavioral Biology.
METHODOLOGICAL AND OPERATIONAL ASPECTS OF PROGRAMMED ENVIRONMENT RESEARCH
H. H. Emurian, C. S. Emurian, E. R. Schmier, and J. V. Brady 16 Apr. 1979 63 p refs
(Contract N00014-77-C-0498)
(AD-A068587; TR-3) Avail: NTIS HC A04/MF A01 CSCL 05/1

This paper presents a narrative and annotated description of several unreported but significant aspects of a methodology which has been perfected over the past several years for conducting research studies within a laboratory environment which is programmed for continuous residence by small groups of human volunteers. The information presented in this paper complements the more formal and in some important ways less complete, presentations of the methods and procedures which have evolved over the past several years. The intent has been to focus upon the many unreported but significant details associated with such studies so that behavioral programming procedures will more readily fall within the interest and scope of other investigators. GRA

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N79-31937# Civil Aeromedical Inst., Oklahoma City, Okla.
OXYGEN EQUIPMENT AND RAPID DECOMPRESSION STUDIES
E. B. McFadden, comp. Mar. 1979 118 p ref
(AD-A070285; FAA-AM-79-13) Avail: NTIS HC A06/MF A01 CSCL 06/11

The protective capability of various oxygen systems at high altitude and during rapid decompression is evaluated. Topics include testing of passenger oxygen masks and portable chemical oxygen generators, oxygen first aid for laryngectome passengers, in-flight decompression, limitations to high altitude operation of small aircraft, and oxygen concentrations in the vicinity of passengers receiving oxygen first aid. K.L.

N79-31938# Army Natick Research and Development Command, Mass. Clothing Equipment and Materials Engineering Lab.
UNITED STATES ARMY ANTHROMETRY: 1946-1977
Robert M. White Jul. 1978 300 p refs
(DA Proj. 1L7-62723-AH-98)
(AD-A068095; CE/MEL-191; NATICK-TR-79/007) Avail: NTIS HC A13/MF A01 CSCL 06/14

Body size information on both men and women of the U.S. Army is available in the form of data collected during several major anthropometric surveys carried out during the past 31 years. Anthropometric data for Army men and women measured in 1946, for Army men and male basic trainees measured in 1966, and for Army women and male basic trainees measured in 1977 are presented in this report. Anthropometric data for these six series of U.S. Army personnel are presented in summary tables, in both centimeters and inches. Data for a total of 118 body measurements have been extracted from the summary tables and collated. Through the use of this format, all of the available anthropometric data for any one body measurement may be seen on two facing pages of statistical and percentile values, either in centimeters or in inches. Data for 14 workspace measurements of both Army men and women also are included. Comparisons of body size between Army men of 1946 and 1966, between Army male basic trainees of 1966 and 1977, between Army women of 1946 and 1977, and between Army men of 1966 and Army women of 1977 are presented and discussed. GRA

N79-31939# Anthropology Research Project, Yellow Springs, Ohio.
ANALYSIS OF BODY SIZE MEASUREMENTS FOR US NAVY WOMEN'S CLOTHING AND PATTERN DESIGN Final Report
John T. McConville, Ilse Tebbetts, and Thomas Churchill Mar. 1979 223 p refs
(Contract N00140-77-C-6882; TF66152309)
(AD-A068600; NCTRF-138) Avail: NTIS HC A10/MF A01 CSCL 06/14

Data from major anthropometric surveys of U.S. Army and U.S. Air Force women are analyzed with a view toward establishing sizing programs for U.S. Navy women's clothing. Summary statistics, percentile and frequency tables, and measurement descriptions are presented for 49 variables related specifically to clothing design. A high degree of comparability was found between the two measured samples in most dimensions, although the Army women, measured in 1976-77, were found to be slightly taller and heavier than the USAF subjects surveyed in 1968, and to have somewhat larger waists and smaller bust dimensions. Using the data from the two military women's surveys and key dimensions and sizing intervals specified by the Navy Clothing and Textile Research Facility, a sizing analysis was conducted. Several different approaches were tried, but the resulting sizing programs do not satisfactorily cover the measured samples and presumably would be similarly deficient for a U.S. Navy population. The authors recommend the selection of different key dimensions and sizing intervals suggested by the actual distribution of body size variability in the military women's samples. GRA

N79-31940# Navy Clothing and Textile Research Facility, Natick, Mass.
ALUMINIZED FIREMEN'S (FIRE PROXIMITY) HANDWEAR: REDESIGN OF EXPERIMENTAL PROTOTYPE Final Report, Oct. 1976 - Sep. 1977
Francis S. Andruk Dec. 1978 11 p refs
(AD-A069895; NCTRF-136; CEEDO-TR-78-06) Avail: NTIS HC A02/MF A01 CSCL 06/17

The Navy Clothing and Textile Research Facility NCTRF continued development work to improve a new experimental configuration of aluminized fire proximity handwear having increased tactility and manipulatory capabilities. An improved prototype was completed and additional quantities of this model are being manufactured for further testing and establishment of thermal protection parameters. Performance of tests is recommended with a view towards completing the program and possible adoption of this new configuration as a replacement for current standard fire proximity handwear. GRA

N79-31941# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
CONTRIBUTIONS OF PSYCHOPHYSIOLOGICAL TECHNIQUES TO AIRCRAFT DESIGN AND OTHER OPERATIONAL PROBLEMS
Robert D. ODonnell (Aerospace Med. Res. Lab., Wright-Patterson AFB, Ohio) Jul. 1979 88 p refs
(AGARD-AG-244; ISBN-92-835-1325-8) Avail: NTIS HC A05/MF A01

Various techniques of proven or potential value to applied areas of human engineering in general, and noting the instances of their application to the human factors of aircraft design in particular are presented. Emphasis was given to the techniques revealing the processes of intervining between stimulus and response. Techniques and problems of psychophysiological measurements are considered along with the current status and future possibilities of research in the areas of sensation and cognition. M.M.M.

N79-31942# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
HUMAN FACTORS ASPECTS OF AIRCRAFT ACCIDENTS AND INCIDENTS
B. O. Hartman, ed. (School of Aerospace Medicine) Jun. 1979 95 p refs In ENGLISH and FRENCH Presented at the Aerospace Med. Panel Specialists' Meeting, Paris, 6-10 Nov. 1978
(AGARD-CP-254; ISBN-92-835-0241-8) Avail: NTIS HC A05/MF A01

A broad spectrum of aircraft accident areas and a number of different approaches to the problem are presented with emphasis on stress and its effects on the body, cognition, and the emotions. For individual titles, see N79-31943 through N79-31953.

N79-31943# Air Force Inspection and Safety Center, Norton AFB, Calif. Life Sciences Div.
THREE DECADES OF USAF EFFORTS TO REDUCE HUMAN ERROR ACCIDENTS, 1947-1977
Andrew F. Zeller *In* AGARD Human Factors Aspects of Aircraft Accidents and Incidents Jun. 1979 9 p (For primary document see N79-31942 22-54)
Avail: NTIS HC A05/MF A01

Thirty years after the formal inception of the USAF, major accidents had been reduced from 1,555 to 90. Human error associated with these accidents was reduced as much as material and other involvements. Analysis of the preventive efforts shows three distinct, although overlapping, approaches which have been employed. The administrative approach is the best known. This investigate-evaluate-fix cycle is the common dimension of almost all accident prevention effort. The scientific approach supplements the information by centering upon a systematic and intensive evaluation of human limitations in a defined man/machine setting. The third concept, total system management, emphasizes improvement in the management of the entire system, though the details of what will be instrumental in the prevention of a specific accident are often not defined. In practice, a viable

accident prevention program incorporates all three approaches, with emphasis defined in relation to need. A.R.H.

N79-31944# Tactical Air Command, Langley AFB, Va. Aerospace Medicine Div.

MEDICAL AND OPERATIONAL FACTORS OF ACCIDENTS IN ADVANCED FIGHTER AIRCRAFT

Leonard W. Johnson, Jr. *In* AGARD Human Factors Aspects of Aircraft Accidents and Incidents Jun. 1979 4 p (For primary document see N79-31942 22-54)

Avail: NTIS HC A05/MF A01

The proper mix and interface between improving aircraft capabilities and man's capabilities and limitations produce success in aerial and aerospace operations. A dysequilibrium between the medical and operational aspects of man and aircraft combine to produce accidents. Some of man's physiological systems and advanced fighter aircraft characteristics are described as well as multiple operational requirements imposed on men who fly high performance fighter aircraft. The interface between the operational requirements and the medical aspects of some of the accidents therein are related. The establishment, in NATO, of a viable aircraft accident information gathering and dissemination program which would prevent accidents in advanced fighter aircraft is proposed. A.R.H.

N79-31945# Belgian Air Force, Brussels.

ANALYSIS OF THE INTERVENTION OF THE HUMAN FACTOR AS A PRINCIPAL CAUSE OR INFLUENCE IN ACCIDENTS OF MIRAGE AIRCRAFT IN THE BELGIAN AIR FORCE [ANALYSE DE L'INTERVENTION DU FACTEUR HUMAIN EN TANT QUE CAUSE PRINCIPALE OU D'INFLUENCE DANS LES ACCIDENTS D'AVIONS MIRAGE A LA FORCE AERIENNE BELGE]

A. Flion *In* AGARD Human Factors Aspects of Aircraft Accidents and Incidents Jun. 1979 6 p In FRENCH (For primary document see N79-31942 22-54)

Avail: NTIS HC A05/MF A01

Statistics are presented showing that, between 1971 and 1977, human factors were responsible for 56 of 91 accidents involving Mirage aircraft used by the Belgian Air Force. Certain parameters likely to be considered eventually in the notion of human factors are analyzed. These include the age of the pilot, his flight experience, the circumstances of the accident in the design of the mission accomplished, the pilot's previous medical history (both physical and psychical), the intervention of leadership, and the interferential factors happening unexpectantly in the triangle formed by man-medium-machine. The effects of the accidents on the pilots are analyzed showing the injuries received, the duration of limited aptitude, and their post-accident careers. Transl. by A.R.H.

N79-31946# Institute of Aviation Medicine, Farnborough (England).

THE PSYCHOLOGIST IN AIRCRAFT ACCIDENT INVESTIGATION

R. G. Green and R. M. Taylor *In* AGARD Human Factors Aspects of Aircraft Accidents and Incidents Jun. 1979 5 p refs (For primary document see N79-31942 22-54)

Avail: NTIS HC A05/MF A01

It is well established that in both military and civil flying operations, a large proportion of all accidents occur in serviceable aircraft where the only failure in the system was in the human element. There is therefore an obvious case for the psychologist to attempt to understand the nature of the errors which are made in the hope that such an understanding may lead to the avoidance of such errors. The way in which RAF psychologists are involved in the accident investigation process is described. The way in which this work has enabled accidents to be categorized is also speculatively discussed and compared with the findings of more academic work. Author

N79-31947# Centro di Studi e Ricerche di Medicina Aeronautica e Spaziale, Rome (Italy).

THE INFORMATION IN AIRCRAFT ACCIDENTS INVESTIGATION

G. Paolucci *In* AGARD Human Factors Aspects of Aircraft Accidents and Incidents Jun. 1979 5 p (For primary document see N79-31942 22-54)

Avail: NTIS HC A05/MF A01

In aircraft accidents, the data achieved by the survey on the spot are completed by information, contributing to reach in such a way the cause of the accident. The fields to investigate are the event, and the man, the machine, and the medium - before, during, and after the accident. Particular attention has to be paid to the witnesses, not only for their declaration, but even and mostly, for the trustworthiness of their evaluation. Ways and techniques for collecting information in this type of investigation are outlined. A.R.H.

N79-31948# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Physik der Atmosphaere.

THE LIMITED RANGE OF THE HUMAN EYE FOR OPTICAL AIRCRAFT ACQUISITION

H.-E. Hoffmann *In* AGARD Human Factors Aspects of Aircraft Accidents and Incidents Jun. 1979 11 p refs (For primary document see N79-31942 22-54)

Avail: NTIS HC A05/MF A01

A pilot flying according to visual flight rules receives the first information from an approaching aircraft when he can just see this aircraft. The distance in which the approaching aircraft can just be seen i.e. detected, is among other things dependent on the contrast threshold of the human eye. The contrast threshold value indicates what extent must have the difference of luminance between object and its background so that this luminance difference can be just perceived. The DFVLR made experiments determining the influence of different contrast threshold values on the maximum detection range; that range in which an approaching aircraft just can be seen. The results of these experiments were also influenced by environmental parameters (e.g. degree of atmospheric turbidity, background, adaptation luminance) and by characteristics of the approaching aircraft (e.g. inherent contrast, size). The conduct of the experiments is described. Author

N79-31949# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany).

ANALYSES OF MIDAIR COLLISIONS IN GERMAN AIRSPACE: METHODOLOGY AND RESULTS

O. Weber *In* AGARD Human Factors Aspects of Aircraft Accidents and Incidents Jun. 1979 14 p refs (For primary document see N79-31942 22-54)

Avail: NTIS HC A05/MF A01

Theoretical studies concerning conflict detection and resolution in visual meteorological conditions by means of the see and avoid concept, and lessons learned from analyses of midair accidents in German airspace are addressed. The methodology is concerned with some supplementary aspects of the visual detection of an aircraft, the observation and extrapolation of its flight path, and the distance limits where an efficient maneuver can be initiated taking observation errors into account. Restrictions of a pilot's ability to detect an approaching aircraft caused by a small apparent size or unfavorable silhouette of that aircraft, and by opaque structures in his cockpit are discussed. Also treated is the apparent track of an aircraft on the windshield in front of the observing pilot. The features of five real midair conflicts in German airspace are demonstrated. G.Y.

N79-31950# Institute of Aviation Medicine, Farnborough (England).

PILOT INCAPACITY IN FLIGHT

D. C. Reader *In* AGARD Human Factors Aspects of Aircraft Accidents and Incidents Jun. 1979 5 p refs (For primary document see N79-31942 22-54)

Avail: NTIS HC A05/MF A01

Incapacity of any crew member of an airplane can have serious implications for the aircraft and occupants. However, in the case of the pilot, the outcome can be disastrous. The hazards of pilot incapacity can be reduced by carrying more than one pilot (such as in transport aircraft). The pilot can be removed from the controls in time to retain control of the aircraft. However, under certain conditions (for instance at low altitudes) this may not be possible; moreover, the pilot may slump forward and restrict the controls. Various restraint systems were devised and these were considered in turn to determine whether their use could avoid the hazards. The incidence of pilot incapacitation

was reviewed in both military and civil aircraft and the risk compared with other flight hazards. G.Y.

N79-31951# Institute of Aviation Medicine, Farnborough (England). General Psychology Section.
GEOGRAPHICAL DISORIENTATION AND FLIGHT SAFETY
R. M. Taylor *In* AGARD Human Factors Aspects of Aircraft Accidents and Incidents Jun. 1979 11 p refs (For primary document see N79-31942 22-54)
Avail: NTIS HC A05/MF A01

Geographical orientation is the psychological process whereby the aircraft pilot maintains an awareness of his position in relation to geographical points. The antithesis, geographical disorientation is a common occurrence in flight, the consequences of which vary in seriousness. Case studies of individual accidents and incidents indicated that in many respects geographical disorientation in flight can be as insidious, compelling and as stressful as spatial disorientation. Geographical disorientation may precipitate spatial disorientation and vice versa. In severe cases, where the realization of the error is sudden, there is evidence of panic and disorganization of behavior leading to loss of control of the aircraft. Preventative actions that may reduce the incidence of geographical disorientation include better training and preflight planning, improved awareness of the problem, elimination of system induced errors, and improved navigation aids, including maps and charts. G.Y.

N79-31952# Italian Air Force Medical Service H. Q., Rome.
HUMAN FACTORS IN PRODUCTION AND PREVENTION OF AIRCRAFT ACCIDENTS DUE TO DISORIENTATION IN FLIGHT
Gaetano Rotondo *In* AGARD Human Factors Aspects of Aircraft Accidents and Incidents Jun. 1979 6 p refs (For primary document see N79-31942 22-54)
Avail: NTIS HC A05/MF A01

To prevent and reduce those flight accidents occasionally due to spatial disorientation, which are tied to the human factor and whose causes can, therefore, be influenced and corrected, it is very important that the pilot has exact knowledge of the possible illusory phenomena which can occur in flight, the awareness that they can be anticipated, and finally that timely actuation of adequate preventive measures allows one to avoid loss of orientation during the various conditions of flight. For that reason the most frequent circumstances and conditions should be examined which can facilitate spatial disorientation in the pilot favoring the mental conflict which originates when there is sensorial incongruity between erroneous sensations coming from the vestibular apparatus and/or the proprioceptors and inadequate visual information. The possible measures necessary to prevent those various conditions contributing to or facilitating disorientation in flight, or neutralizing them whenever they are already in effect, are discussed. G.Y.

N79-31953# National Defence Headquarters, Ottawa (Ontario).
BETWEEN INCIDENT AND ACCIDENT
M. L. Tepper and N. H. Haakonson *In* AGARD Human Factors Aspects of Aircraft Accidents and Incidents 1979 6 p refs (For primary document see N79-31942 22-54)
Avail: NTIS HC A05/MF A01

In the evolution of an aircraft occurrence, combined stress often plays a significant role. Conceptual models of how a combination of stress-inducing factors can lead to the no man's land between normal operation and incident; between incident and accident are presented. The models are primarily for presentation to aircrew when discussing stress. G.Y.

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.
For components see *33 Electronics and Electrical Engineering.*

N79-31954*# Hughes Aircraft Co., Culver City, Calif. Technology Support Div.
ELECTRICAL EVALUATION OF RCA MWS5001D RANDOM ACCESS MEMORY, VOLUME 1 Final Report
A. Klute Jun. 1979 51 p Sponsored by NASA Prepared for JPL 5 Vol.
(Contract JPL-954789)
(NASA-CR-162261; FR-79-76-915-Vol-1; HAC-REF-E0752-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 09B

Electrical characterization and qualification tests were performed on the RCA MWS5001D, 1024 by 1-bit, CMOS, random access memory. Characterization tests were performed on five devices. The tests included functional tests, AC parametric worst case pattern selection test, determination of worst-case transition for setup and hold times and a series of schmoo plots. The qualification tests were performed on 32 devices and included a 2000 hour burn in with electrical tests performed at 0 hours and after 168, 1000, and 2000 hours of burn in. The tests performed included functional tests and AC and DC parametric tests. All of the tests in the characterization phase, with the exception of the worst-case transition test, were performed at ambient temperatures of 25, -55 and 125 C. The worst-case transition test was performed at 25 C. The preburn in electrical tests were performed at 25, -55, and 125 C. All burn in endpoint tests were performed at 25, -40, -55, 85, and 125 C. Author

N79-31955*# Hughes Aircraft Co., Culver City, Calif. Technology Support Div.
ELECTRICAL EVALUATION OF RCA MWS5501D RANDOM ACCESS MEMORY, VOLUME 2, APPENDIX A Final Report
A. Klute Jun. 1979 178 p Sponsored by NASA Prepared for JPL 5 Vol.
(Contract JPL-954789)
(NASA-CR-162262; FR-79-76-915-Vol-2-App-A; HAC-Ref-E0752-Vol-2-App-A) Avail: NTIS HC A09/MF A01 CSCL 09B

The electrical characterization and qualification test results are presented for the RCA MWS5001D random access memory. The tests included functional tests, AC and DC parametric tests, AC parametric worst-case pattern selection test, determination of worst-case transition for setup and hold times, and a series of schmoo plots. The address access time, address readout time, the data hold time, and the data setup time are some of the results surveyed. A.W.H.

N79-31956*# Hughes Aircraft Co., Culver City, Calif. Technology Support Div.
ELECTRICAL EVALUATION OF RCA MWS5001D RANDOM ACCESS MEMORY, VOLUME 3, APPENDIX B Final Report
A. Klute Jun. 1979 548 p Sponsored by NASA Prepared for JPL 5 Vol.
(Contract JPL-954789)

(NASA-CR-162263; FR-79-76-915-Vol-3; HAC-Ref-E0752-Vol-3) Avail: NTIS HC A23/MF A01 CSCL 09B

The electrical characterization and qualification test results are presented for the RCA MWS5001D random access memory. The tests included functional tests, AC and DC parametric tests, AC parametric worst-case pattern selection test, determination of worst-case transition for setup and hold times, and a series of schmoo plots. The test values for the output voltage, average input current, the supply current and the leakage current are presented. A.W.H.

N79-31957*# Hughes Aircraft Co., Culver City, Calif. Technology Support Div.

ELECTRICAL EVALUATION OF RCA MWS5001D RANDOM ACCESS MEMORY, VOLUME 4, APPENDIX C Final Report

A. Klute Jun. 1979 384 p Sponsored by NASA Prepared for JPL 5 Vol.
(Contract JPL-954789)
(NASA-CR-162264; FR-79-76-915-Vol-4; HAC-Ref-E0752-Vol-4) Avail: NTIS HC A17/MF A01 CSCL 09B

The electrical characterization and qualification test results are presented for the RCA MWS5001D random access memory. The tests included functional tests, AC and DC parametric tests, AC parametric worst-case pattern selection test, determination of worst-case transition for setup and hold times, and a series of schmoo plots. Statistical analysis data is supplied along with write pulse width, read cycle time, write cycle time, and chip enable time data. A.W.H.

N79-31958*# Hughes Aircraft Co., Culver City, Calif. Technology Support Div.

ELECTRICAL EVALUATION OF RCA MWS5001D RANDOM ACCESS MEMORY, VOLUME 5, APPENDIX D Final Report

A. Klute Jun. 1979 129 p Sponsored by NASA Prepared for JPL 5 Vol.
(Contract JPL-954789)
(NASA-CR-162265; FR-79-76-915-Vol-5; HAC-REF-E0752-Vol-5) Avail: NTIS HC A07/MF A01 CSCL 09B

The electrical characterization and qualification test results are presented for the RCA MWS 5001D random access memory. The tests included functional tests, AC and DC parametric tests, AC parametric worst-case pattern selection test, determination of worst-case transition for setup and hold times, and a series of schmoo plots. Average input high current, worst case input high current, output low current, and data setup time are some of the results presented. A.W.H.

N79-31959*# Hughes Aircraft Co., Culver City, Calif. Technology Support Div.

ELECTRICAL CHARACTERIZATION OF THE RCA CDP1822SD RANDOM ACCESS MEMORY, VOLUME 1, APPENDIX A Final Report

A. Klute Jun. 1979 164 p Sponsored by NASA Prepared for JPL 3 Vol.
(Contract JPL-954789)
(NASA-CR-162258; FR-79-76-867-Vol-1-App-A; HAC-Ref-E0752-Vol-1-App-A) Avail: NTIS HC A08/MF A01 CSCL 09B

Electrical characteristization tests were performed on 35 RCA CDP1822SD, 256-by-4-bit, CMOS, random access memories. The tests included three functional tests, AC and DC parametric tests, a series of schmoo plots, rise/fall time screening, and a data retention test. All tests were performed on an automated IC test system with temperatures controlled by a thermal airstream unit. All the functional tests, the data retention test, and the AC and DC parametric tests were performed at ambient temperatures of 25 C, -20 C, -55 C, 85 C, and 125 C. The schmoo plots were performed at ambient temperatures of 25 C, -55 C, and 125 C. The data retention test was performed at 25 C. Five devices failed one or more functional tests and four of these devices failed to meet the expected limits of a number of AC parametric tests. Some of the schmoo plots indicated a small degree of interaction between parameters. K.L.

N79-31960*# Hughes Aircraft Co., Culver City, Calif. Technology Support Div.

ELECTRICAL CHARACTERIZATION OF THE RCA CPD-1822SD RANDOM ACCESS MEMORY, VOLUME 2, Final Report

A. Klute Jun. 1979 432 p Sponsored by NASA Prepared for JPL 3 Vol.
(Contract JPL-954789)
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Raw data obtained from functional tests, data retention tests, and AC and DC parametric tests are presented along with schmoo plots. Rise/fall time screening results are included. K.L.

N79-31961*# Hughes Aircraft Co., Culver City, Calif. Technology Support Div.

ELECTRICAL CHARACTERIZATION OF HUGHES HCMP 1852D AND RCA CDP1852D 8-BIT, CMOS, I/O PORTS Final Report

R. L. Stokes Jun. 1979 48 p Sponsored by NASA Prepared for JPL 3 Vol.
(Contract JPL-954789)
(NASA-CR-162259; FR-79-76-869; HAC-Ref-E0752) Avail: NTIS HC A03/MF A01 CSCL 09B

Twenty-five Hughes HCMP 1852D and 25 RCA CDP1852D 8-bit, CMOS, I/O port microcircuits underwent electrical characterization tests. All electrical measurements were performed on a Tektronix S-3260 Test System. Before electrical testing, the devices were subjected to a 168-hour burn-in at 125 C with the inputs biased at 10V. Four of the Hughes parts became inoperable during testing. They exhibited functional failures and out-of-range parametric measurements after a few runs of the test program. K.L.

N79-31962# European Space Agency, Paris (France).

SPACECRAFT ONBOARD DATA MANAGEMENT

T. D. Guyenne, ed. Dec. 1978 338 p refs Presented at ESA/Eurospace Intern. Symp., Nice, France, 24-27 Oct. 1978 (SP-141) Avail: NTIS HC A15/MF A01

A set of 46 lectures is organized into the following groups: standards and standardization, onboard data handling systems, technology, electrical ground support equipment, and payload sensor data processing. For individual titles, see N79-31963 through N79-32008.

N79-31963# European Space Agency, Noordwikj (Netherlands).

THE ESA STANDARDS. PART 1: RATIONALE FOR THE ESA STANDARDS

R. Creasey *In* ESA Spacecraft Onboard Data Management Dec. 1978 p 3-7 refs (For primary document see N79-31962 22-60)
Avail: NTIS HC A15/MF A01

ESA standards governing the ground to space communication links and the internal spacecraft data interfaces are discussed. The motivations for ESA standards are analyzed and their structure is reviewed. The performance requirements and constraints as well as the standardization of spacecraft equipment are presented. Author (ESA)

N79-31964# European Space Data Centre, Darmstadt (West Germany).

THE ESA STANDARDS. PART 2: THE GROUND STATION AND CONTROL CENTER SUPPORT INFRASTRUCTURE

H. Uhrig *In* ESA Spacecraft Onboard Data Management Dec. 1978 p 9-14 (For primary document see N79-31962 22-60)
Avail: NTIS HC A15/MF A01

The motivations and criteria for the selection of the standards for the ground support system are discussed. Advantages of standardization, the key parameters of the space/ground interface in the general purpose ESA network, standards from internationally recognized standardization organizations, the standard digital interfaces, and the structure of ESA's satellite ground support network, are reviewed. Author (ESA)

N79-31965*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

NASA DATA SYSTEM STANDARDS

R. A. Byers *In* ESA Spacecraft Onboard Data Management

Dec. 1978 p 15-17 (For primary document see N79-31962 22-60)
(Contract NAS7-100)
Avail: NTIS HC A15/MF A01 CSCL 09B

The NASA approach to data systems standardization is described. The major thrust of this activity is to assure effective use of NASA resources. The process by which standards are written, who writes them, and what subjects are covered, is briefly examined. Author (ESA)

N79-31966*# National Aeronautics and Space Administration, Washington, D. C.
REFLECTIONS ON THE NASA STANDARDIZATION EFFORT
H. Sonnemann *In* ESA Spacecraft Onboard Data Management Dec. 1978 p 19-24 (For primary document see N79-31962 22-60)
Avail: NTIS HC A15/MF A01 CSCL 09B

The NASA standardization effort which has been in existence for four years is described. A significant number of equipments have been declared standard in order to achieve multimission utilization with the consequent avoidance of high nonrecurring development costs. The small numbers of equipments and significant gaps in time before the next user requires the item raise questions of the value of maintaining a standard, how to assure its producibility economically in the future, and how to prevent its technical obsolescence. Increasing pressures to broaden the participation of industry in the space program have also contributed to a reexamination of the philosophy of standardization. Author (ESA)

N79-31967# European Space Agency, Noordwikj (Netherlands).
ESA ONBOARD DATA HANDLING SYSTEM CONCEPT
P. L. Galbo *In* ESA Spacecraft Onboard Data Management Dec. 1978 p 27-33 (For primary document see N79-31962 22-60)
Avail: NTIS HC A15/MF A01

The onboard data handling (OBDH), a data handling subsystem architecture defined by ESA in order to meet requirements set by the increasing complexity of space missions, is described. Essentially the system comprises, besides remote terminals for acquisition and distribution of data, a number of autonomous, task dedicated peripheral processors which are connected by a standard interface to the central facilities via a data bus. The modular system structure allows expensive for both reliability and/or performance improvement, while the task autonomy of the peripherals both allows the user to optimize his design for his requirements and eases the test and integration problems. Author (ESA)

N79-31968# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
THE ESA STANDARD DATA BUS
B. Fritsch and R. Gunzenhauser *In* ESA Spacecraft Onboard Data Management Dec. 1978 p 35-46 refs (For primary document see N79-31962 22-60)
Avail: NTIS HC A15/MF A01

The results of a study intended to develop a serial data bus suitable for the transmission of data between the different units of the ESA onboard data handling system are presented. A special differential transformer for decoupling of he different driver stages was developed which guarantees that a failure at any of the different bus adapters does not degrade the bus operation. Relevant baseband modulations with self-clocking capability are discussed and various detection methods suitable for bus application are described. Analysis and tests show that bit detection is less critical in designing a data bus than the clock recovery from the transmitted data and the minimization of reflections within the data channel. Different transmission media are investigated. A specification for, and an overall description of the ESA standard data bus is outlined. Author (ESA)

N79-31969# Societe Anonyme de Telecommunications, Paris (France).
THE ESA STANDARD CENTRAL TERMINAL UNIT
A. Lucas *In* ESA Spacecraft Onboard Data Management Dec. 1978 p 47-55 refs (For primary document see N79-31962 22-60)
Avail: NTIS HC A15/MF A01

A central terminal unit compliant with new ESA standards and integrable with the ESA onboard data handling subsystem is presented. The various modules, concerning real time telemetry or memory acquisition capability, telecommand management by a microprocessor-based system, and spacecraft synchronization capability are described. A summary of the performance obtained is included. Author (ESA)

N79-31970# Montedel-Montecatini Edison Elettronica S.p.A., Milan (Italy). Laben Div.
THE ESA STANDARD REMOTE TERMINAL UNIT: PART 1
A. Beretta *In* ESA Spacecraft Onboard Data Management Dec. 1978 p 57-64 (For primary document see N79-31962 22-60)
Avail: NTIS HC A15/MF A01

The remote terminal unit both at system and at unit level is described. The dialog philosophy among the units of the onboard data handling subsystem is discussed, including the protocol adopted for the communication and user interfacing. The Intelligent Terminal Unit description emphasizes the presence of an internal processor (microprocessor based). Applications to EXOSAT and FOC programs and the development of a remote acquisition unit compatible with Spacelab standards are addressed. Author (ESA)

N79-31971# Engins Matra, Velizy (France).
THE ESA STANDARD REMOTE TERMINAL UNIT: PART 2
F. Plisson *In* ESA Spacecraft Onboard Data Management Dec. 1978 p 65-69 (For primary document see N79-31962 22-60)
Avail: NTIS HC A15/MF A01

The software developed for the ESA standard remote terminal unit is described. Both resident programs and application dependent programs are discussed including an analysis of structure and application examples. Author (ESA)

N79-31972# Netherlands Agency for Aerospace Programs, Delft.
ADVANCES IN ONBOARD COMPUTING FOR SATELLITES
G. L. Reijns *In* ESA Spacecraft Onboard Data Management Dec. 1978 p 71-76 refs (For primary document see N79-31962 22-60)
Avail: NTIS HC A15/MF A01

Two disadvantages of the decentralized onboard data handling system are discussed. One disadvantage is related to the interfacing with the system bus and the other disadvantage is inherent to the use of the system in conjunction with an attitude control system. Properties of different random access memories and the use of a cache memory are also examined. Author (ESA)

N79-31973# Engins Matra, Velizy (France).
THE COMMAND AND DATA MANAGEMENT SUBSYSTEM OF SPACELAB
P. Jourdan *In* ESA Spacecraft Onboard Data Management Dec. 1978 p 77-81 (For primary document see N79-31962 22-60)
Avail: NTIS HC A15/MF A01

The command and data management subsystem (CDMS) of Spacelab is described. The CDMS is composed of a subsystem data processing assembly (S/S DPA), an experiment data processing assembly (EXP DPA), a high rate digital assembly, and an intercommunication assembly. Both DPA's are composed of a 125 MS computer, an input-output unit, a remote acquisition unit, and links with the orbiter for telecommand and telemetry as well as time reference. Author (ESA)

N79-31974# Saab-Scania, Goteberg (Sweden).
DATA HANDLING ON BOARD ECS/MARECS AND H-SAT
H. Boerjesson *In* ESA Spacecraft Onboard Data Management Dec. 1978 p 83-89 (For primary document see N79-31962 22-60)
Avail: NTIS HC A15/MF A01

Data handling onboard ECS/MARECS and HSAT is discussed. These satellites are typical examples of the present and maybe the next generation of communication satellites. The data handling tasks consist mainly of the collection, formatting, and transmission

of housekeeping data and the identification and distribution of ground commands. Thus only TM/TC data are treated. No computer data processing is required. The data handling equipment is described starting from the requirements and constraints. The special features and performances are summarized and a brief look into the future is taken. Author (ESA)

N79-31975# Hollandse Signaalapparaten N. V., Hengelo (Netherlands).
THE IRAS ONBOARD DATA HANDLING SYSTEM
H. C. Sprengers *In* ESA Spacecraft Onboard Data Management Dec. 1978 p 89-97 (For primary document see N79-31962 22-60)
Avail: NTIS HC A15/MF A01

The data handling system onboard the Infrared Astronomical Satellite is described. All data handling tasks are more or less executed by the software which is stored in the computer memory. Data handling tasks on board of the satellite (hardware and software) are reviewed. When redundancy is used in a data handling task it is indicated how this redundancy is used and selected. It must be taken into account that loss of data handling for more than one hour results in loss of the total satellite.
Author (ESA)

N79-31976# Centre National d'Etudes Spatiales, Toulouse (France).
DATA HANDLING ONBOARD SPOT
M. Arnaud *In* ESA Spacecraft Onboard Data Management Dec. 1978 p 99-110 refs (For primary document see N79-31962 22-60)
Avail: NTIS HC A15/MF A01

The SPOT multimission service module and first payload are described. The communication and data handling subsystem general characteristics and constraints are analyzed. The main studies and trade-offs examined relative to onboard processing and data handling are presented. A development schedule is discussed. Author (ESA)

N79-31977# Selenia S.p.A., Rome (Italy).
DATA HANDLING ONBOARD EXOSAT
A. DiCecca and R. Gamberale *In* ESA Spacecraft Onboard Data Management Dec. 1978 p 111-119 (For primary document see N79-31962 22-60)
Avail: NTIS HC A15/MF A01

The European X-ray Observation Satellite (EXOSAT), due for launch in 1981, and now undergoing the engineering model phase is described. The EXOSAT will carry onboard a sophisticated data handling subsystem (DHS) which will include a general purpose digital computer (ESA-OBC). The functions performed by the DHS, as required by the mission, are not limited to the usual telemetry and telecommand, but include also the onboard processing of scientific data whose maximum rate (about 160 Kb/sec) has to be compressed, to be made compatible with the telemetry bit rate (8192 b/sec max), without loss of information. As the OBC is fully reprogrammable from the ground via the telecommand link, onboard programs can also be altered or changed in orbit. The DHS was designed mostly in accordance with the ESA OBDH system concept. Author (ESA)

N79-31978# British Aerospace Dynamics Group, Bristol (England). Space Systems Div.
MODULAR PACKAGING FOR ONBOARD UNITS
B. I. Gough *In* ESA Spacecraft Onboard Data Management Dec. 1978 p 123-130 refs (For primary document see N79-31962 22-60)
Avail: NTIS HC A15/MF A01

A standardized modular packaging scheme was specially developed for use in the design and construction of electronic units of the on-board data handling (OBDH) system. The need for and the advantages of such a standardized scheme are discussed, as are the concepts of modularity upon which the design was based. Particular areas are discussed where improvements in hardware and performance capabilities were required in order to satisfy the OBDH system and spacecraft operating requirements. The design of the packaging scheme, which features both mechanical and electrical modularity, is described. An important feature of the design is in the use of a special stacking connector for the electrical interconnection of the modules, which eliminates the use of conventional discrete wiring techniques. Author (ESA)

N79-31979# Ferranti Ltd., Manchester (England).
UNCOMMITTED LOGIC ARRAY TECHNOLOGY
S. F. Colaco *In* ESA Spacecraft Onboard Data Management Dec. 1978 p 131-135 (For primary document see N79-31962 22-60)
Avail: NTIS HC A15/MF A01

A technique for fabricating LSI circuits with short development times and a high degree of design assurance is described. The uncommitted logic array (ULA) is a matrix of identical cells, each comprising a number of transistors and resistors. The array is fully processed as a standard part except for the definition of a single aluminum interconnection pattern which customizes the array for a specific application. The technology used for the ULA, is a semi-custom version of the collector diffusion isolation (CDI) high density bipolar process. As a bipolar process, CDI, has certain advantages over MOS technology. It can operate at high speed or low power, has digital and linear capability, and proven reliability as well as radiation tolerance. Author (ESA)

N79-31980# Societe d'Applications Generales d'Electricite et de Mecanique, Paris (France).
A MAGNETIC BUBBLE RECORDER FOR SPACE APPLICATIONS
M. Toussan, J. C. Gidrol, and M. Poirier *In* ESA Spacecraft Onboard Data Management Dec. 1978 p 137-141 (For primary document see N79-31962 22-60)
Avail: NTIS HC A15/MF A01

A very high reliability magnetic recorder (reliability R = 0.9 over 5 years) project is described. Its main characteristics are: capacity 60 Mbits, serial data transfer of 500 kbits/sec maximum, and high parallel serial data rate for DMA computer connection. Maximum consumption is 20 watts depending on transfer frequency. The system is equipped with bubble memory cases of 4 or 8, 256 kbits chips. The high reliability level required for the recorder will be obtained with its internal reconfiguration with a reconfigurable structure, the storage and transfer data information, and the hardware design. The memory is organized by pages associated with a microprogrammed unit insuring liaison and process between memory pages and user. Data and address busses are duplicated. A supervision unit compares and controls, at every moment, the controller inputs/outputs.
Author (ESA)

N79-31981# Rockwell International Corp., Anaheim, Calif. Bubble Memory Products.
BUBBLE MEMORY TECHNOLOGY
T. M. Steury *In* ESA Spacecraft Onboard Data Management Dec. 1978 p 143-148 refs (For primary document see N79-31962 22-60)
Avail: NTIS HC A15/MF A01

An overview of the spacecraft application potential of bubble memory technology is presented. The present status of the technology is assessed, the use of the technology in spaceborne systems is considered, and future capability is projected. Bubble device status is discussed in terms of device organization, capacities, storage densities, and performance. Application of the technology is considered in terms of preferred approaches to bubble device packaging and storage subsystem organization. A prototype 100 million bit NASA spacecraft data recorder utilizing these approaches is described. Projections of future developments in the technology are made in terms of organization, capacity, and performance parameters.
Author (ESA)

N79-31982# European Space Agency, Noordwikj (Netherlands).
ESA APPROACH TO OBDH TECHNOLOGY
P. May *In* ESA Spacecraft Onboard Data Management Dec. 1978 p 149-153 refs (For primary document see N79-31962 22-60)
Avail: NTIS HC A15/MF A01

The criteria used by ESA in the selection of semiconductor technology for space applications resulted in the selection of CMOS and magnetic bubbles. Standard hybrid packages were designed to reduce expensive and time consuming development of space-qualified hardware. For those parts of an electronic

system which cannot be realized with standard functions, semi-custom circuitry like programmable logic arrays and uncommitted logic arrays were introduced. A more realistic radiation hardening approach was developed and electromechanical parts like printed circuit boards were standardized. A.R.H.

N79-31983# Crouzet Aerospace and Systems, Valence (France).
HYBRID TECHNOLOGY APPLIED TO OBDH
J. C. Arnaud, H. Col, and A. Guillard *In* ESA Spacecraft Onboard Data Management Dec. 1978 p 155-165 (For primary document see N79-31962 22-60)
Avail: NTIS HC A15/MF A01

After a description of hybrid technology, standard circuits for onboard data handling (OBDH) applications are detailed. Hybrid levels and procurement modes are surveyed. New studies in the OBDH area are presented with some examples of realization. Author (ESA)

N79-31984# Teledyne Microelectronics, Los Angeles, Calif.
HIGH-DENSITY PACKAGING OF SEMICONDUCTOR MEMORIES IN HYBRID MICROCIRCUITS
L. A. Sutton *In* ESA Spacecraft Onboard Data Management Dec. 1978 p 167-176 refs (For primary document see N79-31962 22-60)
Avail: NTIS HC A15/MF A01

A high density packaging technique for semiconductor memory devices for high reliability space and military applications is described. Topics covered include design objectives, motives to utilize hybrid packaging technology, partitioning of a memory system, selection criteria for semiconductor memory devices, receiving inspection and electrical test of bare (unpackaged) IC chips, and hybrid fabrication flow which includes process screens and electrical tests in compliance with MIL-STD-883 requirements. Author (ESA)

N79-31985# Electronique Marcel Dassault, St. Cloud (France).
APPLICATION OF HYBRID CIRCUIT TECHNOLOGY TO AEROSPACE DIGITAL CONTROL SYSTEMS
P. Sangouard *In* ESA Spacecraft Onboard Data Management Dec. 1978 p 177-180 (For primary document see N79-31962 22-60)
Avail: NTIS HC A15/MF A01

Thick film hybrid technology use is particularly suitable in aerospace data management equipment, especially for digital processing circuitry realization. After a short survey of production processes and materials used, a competitive analysis is done with other conventional packaging techniques. That comparison based on criteria, such as connection area size and mass production cost, is achieved considering a developed aerospace equipment: the standard coupler data bus. The advantages and limits of hybrid technology are analyzed with regard to size, reliability, production cost, and application cost criteria. The current status and prospects of hybrid technology are surveyed. Author (ESA)

N79-31986# Hollandse Signaalapparaten N. V., Hengelo (Netherlands).
A 16-BIT MICROPROCESSOR BASED ON A MINICOMPUTER
H. C. Sprengers and F. C. Schiereck (Philips Data Sys.) *In* ESA Spacecraft Onboard Data Management Dec. 1978 p 181-187 refs (For primary document see N79-31962 22-60)
Avail: NTIS HC A15/MF A01

A 16 bit microprocessor which is software compatible with the P800 minicomputer family is described. All software programs developed for other P800 minicomputers can directly be loaded into this microprocessor memory. Besides the software compatibility some extra features are incorporated which makes this processor sophisticated. For instance, multiprocessing can be easily implemented. Also user dependent firmware can easily be implemented. Two systems examples are described using this processor-chip. Author (ESA)

N79-31987# Ferranti Ltd., Bracknell (England).
A 16-BIT BIPOLAR MICROPROCESSOR
D. E. Stone *In* ESA Spacecraft Onboard Data Management Dec. 1978 p 189-194 refs (For primary document see N79-31962 22-60)
Avail: NTIS HC A15/MF A01

The F100-L bipolar microprocessor and its hardware and software support products are described. The bipolar collector diffusion isolator technology is introduced and its performance detailed with particular reference to radiation hardness. Classes of support circuits are described that enable additional processing power to be added to the basic microprocessor, simple and complex systems to be constructed, and custom, special-to-system LSI devices to be provided. Software support at both cross-product and resident form is described and specific reference is made to F100 Development Systems. Author (ESA)

N79-31988# European Space Agency, Noordwikj (Netherlands).
ESA SATELLITE CHECK-OUT AND TEST PHILOSOPHY
J. B. Rowles *In* ESA Spacecraft Onboard Data Management Dec. 1978 p 199-206 (For primary document see N79-31962 22-60)
Avail: NTIS HC A15/MF A01

The ESA management scheme, known as the Centralized Management System (CMS) is described. The overall objectives of the CMS and the methods of implementation are reviewed with details given of the systems and logistics involved. Finally, the future satellite checkout requirements and proposed solutions are examined. The system is justified by the complexity of the prelaunch (satellite checkout) equipment, coupled with the need for its absolute integrity as a quality assurance tool, meaning that it cannot be developed and put into operation in the time scale of a single satellite program. Hence, it must be considered as an infrastructure item. The only way to make advances in its capability, in accordance with ever-increasing demands from users, is to use previously proven systems as the starting point for further development. This is essentially the rationale behind ESA's method of provisioning and managing its satellite checkout equipment. Author (ESA)

N79-31989# Montedel-Montecatini Edison Elettronica S.p.A., Milan (Italy). Laben Div.
THE OBDH TEST EQUIPMENT AND ITS GOALS
G. Buroni and M. Pascucci *In* ESA Spacecraft Onboard Data Management Dec. 1978 p 207-214 (For primary document see N79-31962 22-60)
Avail: NTIS HC A15/MF A01

The main features and characteristics of the ESA test equipment for standard onboard data handling (OBDH) subsystems are described with special emphasis on requirements of OBDH testing, standardization, modularity and commonality. Hardware and software functions, automatic facilities, and interface with operator are pointed out. Possibilities of re-use of significant blocks in other test equipments of multiple ESA missions are described. Author (ESA)

N79-31990# European Space Agency, Noordwikj (Netherlands).
SOFTWARE FOR CHECKOUT EQUIPMENT
B. E. Melton *In* ESA Spacecraft Onboard Data Management Dec. 1978 p 215-220 (For primary document see N79-31962 22-60)
Avail: NTIS HC A15/MF A01

Experience gained over several ESA satellite projects resulted in the evolution of standard software to support integration and testing. This software provides the test engineer with a language to define automatic test sequences, a system for monitoring the satellite against a predefined model plus display and archiving facilities for data presentation and storage. This standard software can be augmented on a project-to-project basis to furnish specific nonstandard requirements. Author (ESA)

N79-31991# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).
USE OF CHECKOUT EQUIPMENT FOR SCIENTIFIC SATELLITE TESTING
C. Kurvin and J. Luther *In* ESA Spacecraft Onboard Data Management Dec. 1978 p 221-227 (For primary document see N79-31962 22-60)
Avail: NTIS HC A15/MF A01

Some general problem areas encountered by users of checkout equipment designed specifically for scientific missions are discussed. The basic requirements of scientific satellite checkout equipment, the hardware organization, the software structure,

and the development programs are reviewed. It is concluded that the integration of an experienecd test team in the checkout equipment development program would ensure implementation of the total checkout philosophy. Author (ESA)

N79-31992# Bell Telephone Mfg. Co., Antwerp (Belgium).
SPACELAB INTEGRATION AND CHECKOUT
S. P. Chellingsworth *In* ESA Spacecraft Onboard Data Management Dec. 1978 p 229-236 (For primary document see N79-31962 22-60)
Avail: NTIS HC A15/MF A01

The need for a reliable automated integration and checkout equipment for fast Spacelab turnaround is identified and the various configurations illustrated. The data intensive nature of the task is examined to highlight the complexity and variability of the data paths. An approach based on stratified hardware and software is discussed with flexibility achieved using interpretive programs and late binding techniques. An electrical ground support equipment based on this approach is described in terms of its major assemblies and links, and with reference to its integral health monitoring features. The operator interface is discussed to emphasize the technological design. Author (ESA)

N79-31993# Systems Designers Ltd., Camberley (England).
THE IMPACT OF NEW TECHNOLOGY ON CHECK-OUT
G. W. Holmes, V. Stenning, and A. Levene *In* ESA Spacecraft Onboard Data Management Dec. 1978 p 237-247 refs (For primary document see N79-31962 22-60)
Avail: NTIS HC A15/MF A01

Check-out systems evolved to offer facilities which are effective, proven, and well accepted by their users. However, three major constraints, all undesirable, can be indentified in existing check-out systems: limited processing power, lack of evolutionary capability, and lack of commonality. These constraints are not inherent in the basic concepts or design of the check-out system; rather, they arise at the implementation stage, which introduces restrictions on the modularity and flexibility of the overall system. Advances in hardware and software technology made better implementations both technically and economically feasible. By retaining the existing concepts and facilities, but implementing the check-out system on a modular architecture which is inherently flexible, it should be possible to remove the constraints without sacrificing any of the existing benefits, thereby laying the foundation for a smooth expansion in the capabilities of the check-out systems of the future. Author (ESA)

N79-31994# European Space Agency, Noordwikj (Netherlands).
MAJOR INFLUENCES IN THE DEVELOPMENT OF OVERALL CHECKOUT EQUIPMENT (OCOE)
Des Deaney *In* ESA Spacecraft Onboard Data Management Dec. 1978 p 251-254 ref (For primary document see N79-31962 22-60)
Avail: NTIS HC A15/MF A01

Although standardization of hardware and software is the cornerstone of cost efficiency and reliability of the overall checkout equipment, it must not be allowed to unnecessarily restrict the evolution of the equipment or test methods. Nor, on the other hand, should new technologies be used for their own sake. Some ideas which might be considered as background for a continuous reevaluation of the checkout equipment are given and some of the main areas where changes are taking place which will have a significant impact on the design of future checkout equipment are identified. Author (ESA)

N79-31995# European Space Agency, Noordwikj (Netherlands).
A BRIEF REVIEW OF FUTURE OVERALL CHECKOUT EQUIPMENT (OCOE) REQUIREMENT
J. B. Rowles and Des Deaney *In* ESA Spacecraft Onboard Data Management Dec. 1978 p 255-257 (For primary document see N79-31962 22-60)
Avail: NTIS HC A15/MF A01

Future requirements of a satellite checkout station are briefly reviewed and some suggestions as to how these requirements might be met are made. Comments on the use of the satellite generated time base as a frame of reference to coordinate the various activities of a decentralized real time system are included. G.Y.

N79-31996# European Space Agency, Noordwikj (Netherlands).
GUIDELINES TO MEASURING THE PERFORMANCE OF FUTURE CHECKOUT SYSTEMS
Wim vanLeeuwen *In* ESA Spacecraft Onboard Data Management Dec. 1978 p 259-260 (For primary document see N79-31962 22-60)
Avail: NTIS HC A15/MF A01

Measuring techniques for future overall checkout equipment are discussed. A summary of the existing measuring aids and suggestions on how to further develop these techniques are presented. Author (ESA)

N79-31997# European Space Agency, Noordwikj (Netherlands).
A LOOK AT THE FUTURE OBDH GROUND SUPPORT REQUIREMENTS
Oscar Pace *In* ESA Spacecraft Onboard Data Management Dec. 1978 p 261-263 (For primary document see N79-31962 22-60)
Avail: NTIS HC A15/MF A01

A brief look at future requirements of the ESA Standard Onboard Unit and Sub-system Test Equipment is presented and some suggestions as to how these requirements might be met are made. The introduction of onboard intelligence and the related testing approach together with the necessity of having a clear definition of software/hardware testing interfaces and boundaries are mentioned. The need to have the onboard signals accessible to the test equipment in order to decrease the complexity of the ground hardware and to increase its failure analysis capability is stressed. Finally, a model of the sub-system test process is proposed in order to optimize both the design of the onboard unit/sub-system and the related test equipment. Author (ESA)

N79-31998# European Space Agency, Noordwikj (Netherlands).
SOME THOUGHTS ON NEXT-GENERATION SATELLITE CHECKOUT
Jim Howieson *In* ESA Spacecraft Onboard Data Management Dec. 1978 p 265-266 (For primary document see N79-31962 22-60)
Avail: NTIS HC A15/MF A01

Some guidelines for future test and checkout equipment design, including some user aspects to be considered, are presented. The role of the computer, special peripherals, the test philosophy, and the visual displays are discussed in detail. Author (ESA)

N79-31999# European Space Agency, Noordwikj (Netherlands).
POSSIBLE IMPACT OF MICRO-ELECTRONICS DEVELOPMENT ON THE OPERABILITY AND MAINTAINABILITY ASPECTS OF A GPCOE SYSTEM
Marc Chofflet *In* ESA Spacecraft Onboard Data Management Dec. 1978 p 267 (For primary document see N79-31962 22-60)
Avail: NTIS HC A15/MF A01

An outline of the main areas of a General Purpose Checkout Equipment (GPCOE) system where micro-electronic utilization is likely to improve the operability and maintainability features is presented. It is concluded that a sensible usage of micro-electronics technology can significantly improve the operability and availability of the GPCOE systems with a minimum cost impact at the level of capital involved and a significant savings in terms of operation and maintenance costs. Author (ESA)

N79-32000# Saab-Scania, Goteberg (Sweden).
SIGNAL PROCESSING ONBOARD SCIENTIFIC SATELLITES
E. Mattsson *In* ESA Spacecraft Onboard Data Management Dec. 1978 p 271-274 refs (For primary document see N79-31962 22-60)
Avail: NTIS HC A15/MF A01

A study of the onboard data handling system computer is presented. The objectives of the study are to evaluate the capability of this system with respect to the processing extraction and compression of data from experiments, and to define and implement standard routines applicable to typical categories of experiments. The particular algorithms described carry out processing, extraction, and compression of data on the signals generated by the experiments. Details on the actual hardware configuration are provided. Author (ESA)

N79-32001# European Space Agency, Noordwikj (Netherlands).
PAYLOAD SENSOR DATA PROCESSING ASPECTS
R. W. Okkes *In* ESA Spacecraft Onboard Data Management Dec. 1978 p 275-277 (For primary document see N79-31962 22-60)
Avail: NTIS HC A15/MF A01

The benefits which could be obtained by performing the processing of payload sensor data on board the spacecraft are considered. Following a general description, its applicability to earth observation missions with respect to processing of SAR (Synthetic Aperture Radar) data and image data reduction on board is covered in some detail. The achievements made within the European Space Agency in the area of payload sensor data processing are summarized and the development program to implement the required facilities for future missions is indicated. Author (ESA)

N79-32002# European Space Operations Center, Darmstadt (West Germany).
PAYLOAD DATA PRE-PROCESSING
C. Mazza *In* ESA Spacecraft Onboard Data Management Dec. 1978 p 279-290 refs (For primary document see N79-31962 22-60)
Avail: NTIS HC A15/MF A01

Some aspects of overall payload data management normally indicated as pre-processing activities are reviewed. Pre-processing deals with the correction or geometric and radiometric distortions to give an image corresponding to an idealized undistorted system. A summary of the most important processing functions and of the corresponding algorithms is given. The results of an investigation on ground control points selection through the sequential similarity detection algorithm, a mapping function definition, computations, and image resampling techniques are presented. Where pre-processing is applicable, some aspects of pre-processing potential are examined. Author (ESA)

N79-32003# Engins Matra, Velizy (France). Lab. de Traitment des Images.
IMAGE DATA REDUCTION
G. E. Lowitz *In* ESA Spacecraft Onboard Data Management Dec. 1978 p 291-298 refs Sponsored by ESTEC Original contains color illustrations (For primary document see N79-31962 22-60)
Avail: NTIS HC A15/MF A01

A survey of some ESA sponsored image processing research is presented. Subjects reviewed include cluster compression of multispectral imagery, iterative clustering algorithms, clustering into a variable (adaptive) number of classes, end to end data management cost benefits, thematic mapping of a whole frame, noise filtering, and cascade clustering. Author (ESA)

N79-32004# Ferranti Ltd., Bracknell (England).
SYNTHETIC APERTURE RADAR REAL TIME PROCESSING
D. J. Bonfield, K. M. Harvey, and J. R. E. Thomas *In* ESA Spacecraft Onboard Data Management Dec. 1978 p 299-308 refs (For primary document see N79-31962 22-60)
Avail: NTIS HC A15/MF A01

Several synthetic aperture radar real time processor architectures, suitable for use onboard a satelilite, are discussed. The principles of Synthetic Aperture Radar (SAR) are explained. Data processing for SAR, SAR azimuth processing architectures, multilook processing, and image formatting are reviewed in detail. The applicability of charge coupled devices and surface acoustic wave devices to the implementation of these architectures is examined. Author (ESA)

N79-32005# Marconi Co. Ltd., Great Baddow (England).
GROUND PROCESSING OF SEASAT-A SAR DATA AT AN EARTHNET STATION
A. B. E. Ellis *In* ESA Spacecraft Onboard Data Management Dec. 1978 p 309-316 refs (For primary document see N79-31962 22-60)
Avail: NTIS HC A15/MF A01

A proposed ground based processor for SEASAT-A Synthetic Aperture Radar (SAR) is described. The data from the satellite is recorded digitally prior to being correlated in both the range and along-track directions to produced a radar image of a strip of the ocean. Problems associated with range migration and with image geometric accuracy are discussed. The resolution is nominally 25 m x 25 m over a swath width of 100 km and swath length of 4000 km. Author (ESA)

N79-32006# Compagnie d'Informatique Militaire, Spatiale et Aeronautique, Velizy-Villacoublay (France).
SEASAT-A GROUND PROCESSING WITH STANDARD HARDWARE: MITRA 125 AND PROPAL 2
Y. LeGal and J. C. Gilbert *In* ESA Spacecraft Onboard Data Management Dec. 1978 p 317-324 (For primary document see N79-31962 22-60)
Avail: NTIS HC A15/MF A01

Advanced systems for the numerical processing of SAR (Synthetic Aperture Radar) images are described. Several data processing system architectures are proposed, built around the MITRA 125 computers and the PROPAL 2 associative parallel processor. The various systems are characterized by their processing power and their ability to support different numerical image processing algorithms. The highest performance system in the first study processes 40 images in 24 hours. The system proposed in the second study processes one image in about 8 hours. All these systems are entirely programmable; they can support diverse processing algorithms and can be used for developing and validating all other computational methods. Author (ESA)

N79-32007# Royal Aircraft Establishment, Farnborough (England).
A DIGITAL SAR PROCESSOR FOR SEASAT-A
D. G. Corr (Sys. Designers, LTD.) and A. Haskell *In* ESA Spacecraft Onboard Data Management Dec. 1978 p 325-327 (For primary document see N79-31962 22-60)
Avail: NTIS HC A15/MF A01

An experimental digital SAR processing facility for data from SEASAT-A was designed and is currently being implemented. In order to gain a complete understanding of the processes involved in SAR imaging, and to achieve maximum image quality, the processing algorithms used are as near as possible exact. For this reason azimuthal compression is performed in the time domain and corrections are included for various system functions. The processing facility will allow radar images up to approximately 50 km square to be obtained. Author (ESA)

N79-32008# European Space Agency, Noordwikj (Netherlands).
TYPICAL APPLICATIONS OF THE ESA OBDH SUBSYSTEM
D. C. Chaturvedi *In* ESA Spacecraft Onboard Data Management Dec. 1978 p 329-332 ref (For primary document see N79-31962 22-60)
Avail: NTIS HC A15/MF A01

A data handling subsystem configuration, based on the new OBDH (Onboard Data Handling Subsystem) architecture defined by ESA is proposed. This configuration in its basic form fulfills the needs of a mission with modest requirements. However, the same configuration, with the addition of special function modules, can be made to fulfill the requirements of a more complex mission. It is suggested that this configuration, apart from being cost effective, is also competitive in weight and power consumption against special to purpose design of the past satellites. Author (ESA)

N79-32009# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
THE DESIGN AND DEVELOPMENT OF A HYBRID MONITOR/DEBUGGER SYSTEM FOR THE MICROPROGRAMMABLE MINICOMPUTER EMULATOR, MIME M.S. Thesis
Joseph J. Zelasco, Jr. Mar. 1979 156 p refs (AD-A069193; AFIT/GE/EE/79-3) Avail: NTIS HC A08/MF A01 CSCL 09/2

This report describes the design and development of a monitor/debugger system for the Microprogrammable Minicomputer Emulator (MIME). The MIME is an educationally oriented, user-microprogrammable, general purpose minicomputer that will be used in classroom and laboratory instruction and student design projects in the areas of computer control, emulation, and microprogramming. The MIME Monitor/Debugger System will assist students in developing microprograms to run on the MIME

and will also assist in the final integration and checkout of the MIME hardware. This report analyzes the conceptual implementations of monitor/debugger systems and applies these implementations to the MIME computer. The analysis results are presented which recommend that a dual processor hybrid monitor/debugger implementation should be developed for the MIME. This implementation of a hybrid system combines the flexibility of software with the speed of hardware. The MIME Monitor/Debugger System design presented in this report when fabricated and tested, will produce a monitor/debugger system that is interactive with the system user, has the flexibility to encompass changing user requirements, and has the speed to monitor and control the real-time operation of the MIME computer. GRA

N79-32010# Lincoln Lab., Mass. Inst. of Tech., Lexington.
A NEW DESIGN FOR THE PROGRAMMABLE BUTTON SYSTEM AT THE GEODSS ETS
Lawrie E. Eaton 14 Mar. 1979 18 p ref
(Contract F19628-78-C-0002; AF Proj. 2128)
(AD-A069371; ETS-39; ESD-TR-79-42) Avail: NTIS HC A02/MF A01 CSCL 09/2

Two new design approaches are presented for upgrading the programmable button interface at the GEODSS ETS. These designs make use of the Motorola microprocessors. The design simplifies the logic, standardizes the interface to the host computer and provides increased versatility with the microprocessor software. This document assumes the reader is familiar with the GEODSS Experimental Test System ETS and its basic operational configuration. GRA

N79-32011# Illinois Univ. at Urbana-Champaign. Coordinated Science Lab.
THE DESIGN OF MICROCOMPUTER SYSTEMS M.S. Thesis
Thomas Alan Lane Jul. 1978 178 p refs
(Contract DAAB07-72-C-0259)
(AD-A069768; R-817) Avail: NTIS HC A09/MF A01 CSCL 09/2

The nature of integrated circuit technology dictates an upper limit on the number of gates that can be placed on a single chip and still permit production that is economically feasible. This upper limit is constantly being increased by improving technology. The first integrated circuits had a small number of individual gates on a chip. As technology progressed, medium-scale-integrated (MSI) chips were produced with complex functions such as multiplexers, counters and shift registers. Early in the 1970's the maximum number of gates had increased to the point where a complete system or subsystem, such as a microprocessor could be placed on a single chip. This technology is referred to as large-scale-integration (LSI). GRA

N79-32012# Naval Surface Weapons Center, Dahlgren, Va.
INPUTP(GENERAL PURPOSE INPUT PROCESSOR) USER GUIDE Final Report
Peter J. Goyette Jan. 1979 49 p refs
(AD-A069809; NSWC/DL-TR-3880) Avail: NTIS HC A03/MF A01 CSCL 09/2

The General Purpose Input Processor (INPUTP) program is a very flexible, entirely data-driven utility that may be used as an input preprocessor to any FORTRAN program. The INPUTP program reads two external files to define the names and default values for all user input. Then through input, the user may override the default values for any input parameters. The input processor generates two FORTRAN block data routines containing DATA statements to define the input parameters. These routines must be compiled and loaded to initialize all input variables. All data is read by the input processor in a free-form format, which simplifies the creation and maintenance of the data files and greatly reduces the chances for user input errors. The INPUTP program is coded in the SIMSCRIPT II.5 language, and is operational on the Control Data Corporation (CDC) 6700 computer system under the SCOPE 3.4 operating system. GRA

N79-32013# Sandia Labs., Albuquerque, N. Mex.
MICROPROCESSOR CONTROLLED DATA ACQUISITION SYSTEM
R. L. White Jul. 1978 30 p refs
(Contract EY-76-C-04-0789)
(SAND-78-1319) Avail: NTIS HC A03/MF A01

A basic data collection system with a modular programming approach is described. The use of a microprocessor with this system allows system function and data formats of input and output to be changed with minimal hardware changes. The system has wide application. DOE

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N79-32014*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
COMPUTER PROGRAM DEVELOPMENT AND USER'S MANUAL FOR PROGRAM PARACH
Hughlen I. Murphree Sep. 1979 68 p
(NASA-TM-78238) Avail: NTIS HC A04/MF A01 CSCL 09B

A user's manual is provided for program PARACH, a FORTRAN digital computer program operational on the Univac 1108. A description of the program and operating instructions for it are included. Program PARACH is used to study the interaction dynamics of a parachute and its payload during terminal descent. Operating instructions, required input data, program options and limitations, and output data are described. Subroutines used in this program are also listed and explained. A.W.H.

N79-32015# Auburn Univ., Ala. Engineering Experiment Station.
CORRELATION ALGORITHM DEVELOPMENT Final Technical Report, 1 Dec. 1978 - 30 Apr. 1979
J. S. Boland, III and H. S. Ranganath 30 Apr. 1979 70 p
(Contract DAAK40-79-M-0016)
(AD-A069208) Avail: NTIS HC A04/MF A01 CSCL 09/3

This report presents the results and conclusions derived from simulation of correlation of TV images obtained from two sensors sensitive in the visual spectrum. Eight scenes were used with a variety of spatial frequency content and contrast ratios. Three methods of obtaining a threshold for bi-level quantization are also studied. A comparison of the shapes of the correlation surfaces about the true correlation peak and about false peaks is given. GRA

N79-32016# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
DESIGN FOR AN AUTOMATED STATUS ACCOUNTING SYSTEM FOR SOFTWARE CONFIGURATION MANAGEMENT M.S. Thesis
Alexander Schuster Mar. 1979 244 p refs
(AD-A069300; AFIT/GCS/EE/79-2) Avail: NTIS HC A11/MF A01 CSCL 09/2

This report documents a design effort for an automated system to record and report the configuration status of software for Air Force embedded computer systems. The work included requirements analysis, software design, and data-base design. Because of the flexibility given to program managers in tailoring their reporting requirements and in selecting the data integrator, only the requirements of a single AFSC program office were presented in detail. However, the requirements of other offices were considered as well. Current software engineering techniques were used to derive the design. They are highly recommended for use on other software development projects. GRA

N79-32017# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
EVALUATION OF AN EXISTING COMPUTER SYSTEM USING STRUCTURED ANALYSIS TECHNIQUES M.S. Thesis
Dennis L. Schweitzer Mar. 1979 161 p refs
(AD-A069210; AFIT/GCS/EE/79-3) Avail: NTIS HC A08/MF A01 CSCL 09/2

This thesis is an evaluation of an existing computer graphics system using structured analysis techniques. The system evaluated is the IMLAC PDS-4 minicomputer. The technique used in the

evaluation is performed in three steps. First, the existing system is modeled into its logical equivalent using bubble charts. This model shows the flow of data through the system, and the activities performed on that data. Second, a similar model is produced describing the required system as defined by the users. This model is a representation of the users' desires and requirements, and is similar to a model which might be produced during the requirements definition phase of a computer's life cycle. The third step is to compare the two models to evaluate the existing system's effectiveness, and reveal areas requiring modification for full utilizatin of the system. Following the evaluation, several recommendations and changes are proposed to increase the system's capability to meet the user requirements. GRA

N79-32018# George Washington Univ., Washington, D. C. Program in Logistics.

AN EXPLICIT SOLUTION TO THE MULTI-LEVEL PROGRAMMING PROBLEM

Jonathan F. Bard and James E. Falk 26 Mar. 1979 50 p refs

(Contract N00014-75-C-0729)

(AD-A069310; Serial-T-388) Avail: NTIS HC A03/MF A01 CSCL 12/1

The multi-level programming problem is defined as an n-person nonzero-sum game with perfect information in which the players move sequentially. The bi-level linear case is addressed in detail. Solutions are obtained by recasting this problem as a standard mathematical program and appealing to its implicitly separable structure. The reformulated optimization problem is linear save for a complementary constraint of the form $<u,g> = 0$. This constraing is decomposed in a manner that permits us to achieve separability with very little cost in dimensionality. A general branch and bound algorithm is then applied to obtain solutions. Unlike the conventional mathematical program though, the multi-level program may fail to have a solution even when the decision variables are defined over a compact set. An auxiliary optimization problem is employed to detect such failure. Finally, the general max-min problem is discussed within the bi-level programming framework. Examples are given for a variety of related problems. GRA

N79-32019# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.

DECENTRALIZED MAXIMUM FLOW ALGORITHMS

Adrian Segall May 1979 32 p refs Prepared in cooperation with Technion - Israel Inst. of Tech., Haifa

(Contracts N00014-75-C-1183; N00014-77-C-0532)

(AD-A069991; LIDS-P-915) Avail: NTIS HC A03/MF A01 CSCL 12/2

This paper presents three algorithns for obtaining maximum flow in a network using distributed computation. Each node in the network has memory and processing capabilities and coordinates the algorithm with its neighbors using control messages. Each of the last two versions requires more sophistication at the nodes than the previous one, but on the other hand employs less communication. GRA

N79-32020# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.

SYNCHRONIZATION MECHANISMS FOR MODULAR PROGRAMMING LANGUAGES M.S. Thesis

Toby Bloom Jan. 1979 120 p refs

(Contract N00014-75-C-0661; Grant NSF MCS-74-21892)

(AD-A069819; MIT/LCS/TR-211) Avail: NTIS HC A06/MF A01 CSCL 09/2

Any programming language that supports concurrency needs a synchronization construct with which to express access control for shared resources. This thesis examines synchronization constructs from the standpoint of language design for reliable software. The criteria a synchronization mechanism must satisfy to support construction of reliable, easily maintainable concurrent software are defined. Some of these criteria, such as expressive power, can be defined only with respect to the set of problems the mechanism is expected to handle. A definition of the range of problems considered to be synchronization problems is therefore needed. Such a definition is provided by describing the possible types of constraints that may be imposed on access to shared resources. We then use this taxonomy of synchronization constraints to develop techniques for evaluating how well synchronization constructs meet the criteria discussed. These techniques are then applied to three existing synchronization mechanisms: monitors, path expressions, and serializers. Evaluations are presented, and the three mechanisms compared. GRA

N79-32021# Southern Methodist Univ., Dallas, Tex. Dept. of Computer Science.

IMPLEMENTATION AND EVALUATION OF INTERNAL ARITHMETIC SOFTWARE. REPORT 5: THE CDC CYBER 70 SYSTEM

David A. Cohn, J. Brian Potter, and Myron Ginsberg Apr. 1979 107 p refs

(Contract DACA39-77-M-0105; Grant NSF MCS-77-06611)

(AD-A070375; WES-TR-0-79-1) Avail: NTIS HC A06/MF A01 CSCL 09/2

This is Report 5 of a series entitled 'Implementation and Evaluation of Interval Arithmetic Software'. The potential user of this or any other interval analysis package should take into consideration the limitations of this technique. Some of the limitations are inherent in all interval analysis implementations and others are dependent upon one specific package. The user should be aware that software interval analysis tends to be very slow. Cases run on one CDC Cyber 70 have required as much 100-fold increase in execution time over a noninterval version. Thus, large production codes involving significant amounts of floating-point computations are not viable candidates for a complete interval implementation. However, small portions of the computation might benefit from use of the package. The computed bounds using interval analysis can be overly pessimistic as well as being time-consuming to determine. The tightness of the bounds is dependent upon the arithmetic of the host computer and possible numerical anomalies introduced by compile-time arithmetic. Another factor affecting the performance of the interval package is the accuracy of the host computer's FORTRAN library routines. GRA

N79-32022# Oak Ridge Gaseous Diffusion Plant, Tenn.

DESCRIPTION OF DATA ENTRY FOR AUTOMATED COST ESTIMATING

N. H. VanWie Apr. 1979 45 p refs

(Contract W-7405-eng-26)

(K/CSD/TM-29) Avail: NTIS HC A03/MF A01

A series of computer programs was developed to aid in the computation and reporting of a proiect cost estimate. These programs are operative on any project, regardless of scale, as long as a minimal set of rules for preparation of the data base is followed. The data base for a project is subdivided into four types of data or files: a title file, a front-end file, a file of cost sheets for the base cost estimate, and a file of cost items with their schedules for the time-phased estimate. The data requirements formating and specifications for preparation of these files to enable computation are described. Examples are presented and alternative approaches to accomplish an end result are explained. DOE

N79-32023# Argonne National Lab., Ill.

IMPLEMENTATION AND TESTING OF OPTIMIZATION SOFTWARE

J. J. More 1978 16 p refs

(Contract W-7405-eng-38)

(DOE/TIC-10096) Avail: NTIS HC A02/MF A01

The development of a transportable optimization software is outlined. Guidelines for the implementation of optimization software are suggested, and the (often dramatic) effect that these guidelines have on the performance of the implementation is shown. In addition, the weaknesses in the usual approaches to performance testing of optimization software are discussed and some remedies are suggested. DOE

N79-32024# Argonne National Lab., Ill.

TESTING UNCONSTRAINED OPTIMIZATION SOFTWARE

Jorge J. More, B. S. Garbow, and K. E. Hillstrom Jul. 1978 96 p refs

(Contract W-31-109-eng-38)

(ANL-AMD-TM-324) Avail: NTIS HC A05/MF A01

The testing of optimization software for efficiency, reliability, and robustness is addressed. A relatively large but easy-to-use collection of test functions and guidelines for testing the reliability and robustness of unconstrained optimization software are described. DOE

N79-32025# Applications Mathematiques et Logiciel (AML) SARL, Neuilly-sur-Seine (France).
NUMERICAL STUDY OF CONSERVATIVE FILTERS. VOLUME 1: ALGORITHMS AND EXPERIMENTS
Jacques Boissieres and Simon Larcher Dec. 1978 69 p 2 Vol.
(Contract ESOC-3365/78-D-JS(SC))
(ESA-CR(P)-1208-Vol-1) Avail: NTIS HC A04/MF A01

The results of a numerical study of conservative filters are presented in a two volume report. In this volume the algorithms used and the experiments conducted are described. A variety of conservative prediction and updating filtering algorithms, which were obtained in a previous theoretical study, were implemented and tested. After a unified reformulation of the algorithms for the different concepts of conservativity, a general numerical method was devised to obtain conservative terms by optimization techniques. Moreover, procedures to select in an optimum way arbitrary parameters in algorithms were designed. The methods were implemented and tested in typical orbit determination problems. Tests were made separately for the prediction and for the updating step, since they are of a totally different nature. Results obtained are reported and commented on. Besides the verification of conserveness, they point out satisfactory results, but at the same time reveal some critical items in the applications. The software used is also described in detail. Author (ESA)

N79-32026# Applications Mathematiques et Logiciel (AML) SARL, Neuilly-sur-Seine (France).
NUMERICAL STUDY OF CONSERVATIVE FILTERS. VOLUME 2: SOFTWARE DESCRIPTION
Jacques Boissieres and Simon Larcher Dec. 1978 170 p 2 Vol.
(Contract ESOC-3365/78-D-JS(SC))
(ESA-CR(P)-1208-VOL-2) Avail: NTIS HC A08/MF A01

The results of a numerical study of conservative filters are presented in a two volume report. In this volume a complete description of the software is given. The conservative filter software is composed of the filter package itself and a special program of plotting. The filter package is divided into four steps with an overlay structure. For the overly structure, a user's guide chapter is included. A seperate plotting program uses two files generated by the filter to produce a picture file which can be used by Tektronix of Stromberg-Carlson devices. References to volume 1 details concerning the implemented equations are given.
Author (ESA)

62 COMPUTER SYSTEMS

Includes computer networks.

N79-32027# Illinois Univ. at Urbana-Champaign. Coordinated Science Lab.
DEPTH ORIENTED DESIGN FOR NAND NETWORKS Ph.D. Thesis
James Paul Rutledge Nov. 1978 134 p refs
(Contract DAAB07-72-C-0259)
(AD-A069765; R-832; UILU-ENG-78-2225) Avail: NTIS HC A07/MF A01 CSCL 09/2

The design of high speed digital systems requires careful effort to minimize the propagation delay through combinational logic networks. For technological reasons these networks are often most desirably constructed from either NAND or NOR gates with various fan-in limits. It is simpler for the designer to write Boolean expressions which define the desired network behavior in terms of the general class of binary Boolean operators (henceforth referred to as B2) instead of multiple input NAND or NOR operators. The main objective of this paper is to provide a methodology for convenient design of combinational networks. The techniques provided here are not merely existence proofs but are constructive and could, for example, be implemented in the form of computer programs to convert expressions with very large numbers of literals to networks meeting the indicated bounds, leaving only small (eg. 3 to 5 literals) networks to be constructed by hand or through table search. All bounds and constructions in this paper are based upon the size of the input expressions where for any expression E the size of E is represented by abs. val. (E) and is equal to the number of literals in E. The techniques presented treat each literal as distinct (eg. AB-AC has 4 literals). Thus, these techniques are most useful when the size of the expression is large and the number of repetitions of variable names is relatively small. GRA

N79-32028# SEMA (Metra International), Paris (France).
DEVELOPMENT OF A COMPUTER SYSTEM FOR THE CALCULATION AND MANAGEMENT OF THERMAL MATHEMATICAL MODELS: STEP 2 Final Report
A. Gruyer and J. M. LeGlas Aug. 1978 417 p refs
(Contract ESTEC-3438/77-NL-PP(SC))
(ESA-CR(P)-1186) Avail: NTIS HC A18/MF A01

Concerning view factors computation, previous work was continued in order to define algorithms ensuring sufficient precision in any case. New preshade methods were developed so that the system would save a lot of central processing unit time when modifying of combining models. Much work was done on the management aspects; items and concepts are precisely defined and a first description of the specifications of the treatments is presented. Author

63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support.*

N79-32029*# Massachusetts Inst. of Tech., Cambridge.
THE GENERALIZED POLE ASSIGNMENT PROBLEM
T. E. Djaferis and S. K. Mitter Sep. 1979 8 p refs
(Grant NGL-22-009-124; Contract E(49-18)-2087)
(NASA-CR-162268; LIDS-P-944) Avail: NTIS HC A02/MF A01 CSCL 09B

Two dynamic output feedback problems for a linear, strictly proper system are considered, along with their interrelationships. The problems are formulated in the frequency domain and investigated in terms of linear equations over rings of polynomials. Necessary and sufficient conditions are expressed using genericity. K. L.

N79-32030*# Massachusetts Inst. of Tech., Cambridge.
A MULTILOOP GENERALIZATION OF THE CIRCLE CRITERION FOR STABILITY MARGIN ANALYSIS
Michael G. Safonov and Michael Athans 1 Sep. 1979 32 p refs
(Grants NGL-22-009-124; NsG-1312; Contracts F44620-76-C-0061; N00014-75-C-0144; Grant NSF ENG-78-05628)
(NASA-CR-162267; LIDS-P-946) Avail: NTIS HC A03/MF A01 CSCL 09B

In order to provide a theoretical tool suited for characterizing the stability margins of multiloop feedback systems, multiloop input-output stability results generalizing the circle stability criterion are considered. Generalized conic sectors with 'centers' and 'radii' determined by linear dynamical operators are employed to specify the stability margins as a frequency dependent convex set of modeling errors (including nonlinearities, gain variations and phase variations) which the system must be able to tolerate in each feedback loop without instability. The resulting stability criterion gives sufficient conditions for closed loop stability in the presence of frequency dependent modeling errors, even when the modeling errors occur simultaneously in all loops. The stability conditions yield an easily interpreted scalar measure of the amount by which a multiloop system exceeds, or falls short of, its stability margin specifications. K.L.

N79-32031# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
SEGMENTATION OF TOUCHING ENGLISH LETTERS

M.S. Thesis
Roy Edward Bentkowski Mar. 1979 138 p refs
(AD-A069298; AFIT/GE/EE/79-1) Avail: NTIS HC A07/MF A01 CSCL 09/2

This paper examines the problem of building a machine to read uncontrolled type fonts set with essentially no space between letters (within words). The consequence of this type of data, which represents the usual format of printed text, is that the data vectors produced by the optical scanner contain multiple letters and/or fragments of letters that cannot be easily separated. An algorithm based on a variant of running cross-correlation between prototype letters and successively 'windowed' fragments of the sentence is employed. The algorithm computes the Euclidean distance between prototypes and the sentence fragment in a filtered Fourier domain. It is shown that appropriate normalizaton and windowing techniques allow perfect recognition of touching letters within words. This occurs even when no a priori knowledge of letter location within the word is available, provided that suitable prototypes can be established. Multiple alphabet prototypes were then built and used to examine widely differing type fonts. Techniques to set acceptance thresholds were evaluated and the behavior of the resulting recognition system tabulated. A number of false triggers did occur in this case and these were discussed. Recommendations for further improvements in the system are suggested. GRA

N79-32032# Illinois Univ. at Urbana-Champaign. Coordinated Science Lab.
MODEL REDUCTION AND DECENTRALIZED CONTROL OF LARGE SCALE SYSTEMS USING CHAINED AGGREGATION Ph.D. Thesis
Edwin Chi Yu Tse Aug. 1978 257 p refs
(Contracts DAAB07-72-C-0259; EX-76-C-01-2088)
(AD-A069766; R-820; UILU-ENG-78-2213) Avail: NTIS HC A12/MF A01 CSCL 12/1

This report proposes the model reduction of linear time invariant systems and the synthesis of decentralized control with parallel computations by utilizing the given system information structure, e.g., structural and output information. We first develop the chained aggregation procedure which leads to the generalized Hessenberg system representation (GHR). The structural features of the GHR are studied. The influences of the Hessenberg Blocks on trajectory and eigenvalue perturbation are examined. Secondly we develop the generalized QL (GQL) and the restricted QL (RQL) algorithms to be used in conjunction with the GHR for construction of reduced order models. The GHR is shown to exhibit as class of plausible reduced order models suitable for further parameter adjustment if necessary. Finally, we exploit the use of GHR structure for the synthesis of decentralized control in the tracking of reference interconnection variables in an interconnected large scale system. A hierarchical structure is proposed which allows decentralized and parallel computations. Model reduction and control synthesis are illustrated using power system and rocket dynamics as examples. GRA

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N79-32033*# National Aeronautics and Space Administration, Washington, D. C.
CONCERNING AN APPLICATION OF THE METHOD OF LEAST SQUARES WITH A VARIABLE WEIGHT MATRIX
A. A. Sukhanov Sep. 1979 29 p refs Transl. into ENGLISH of "O primenenii metoda naimenshikh kvadratov s peremennoy vesovoy Matritsyey" Acad. of Sci. USSR, Moscow, Rept. Pr-481, 1979 33 p Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-2791)
(NASA-TM-75669; Pr-481) Avail: NTIS HC A03/MF A01 CSCL 12A

An estimate of a state vector for a physical system when the weight matrix in the method of least squares is a function of this vector is considered. An iterative procedure is proposed for calculating the desired estimate. Conditions for the existence and uniqueness of the limit of this procedure are obtained, and a domain is found which contains the limit estimate. A second method for calculating the desired estimate which reduces to the solution of a system of algebraic equations is proposed. The question of applying Newton's method of tangents to solving the given system of algebraic equations is considered and conditions for the convergence of the modified Newton's method are obtained. Certain properties of the estimate obtained are presented together with an example. K.L.

N79-32034# Clemson Univ., S.C. Dept. of Mathematical Sciences.
CHI-SQUARE TESTS FOR THE MULTINOMIAL DISTRIBUTION
Khursheed Alam 5 Dec. 1978 10 p refs
(Contract N00014-75-C-0451)
(AD-A069456; N104; TR-296) Avail: NTIS HC A02/MF A01 CSCL 12/1

This paper gives a proof of the asymptotic property of the Chi-square tests associated with the multinomial distribution, generally used in the analysis of categorical data, such as contigency tables. GRA

N79-32035# Wisconsin Univ. - Madison. Mathematics Research Center.
EFFICIENT TIME-STEPPING PROCEDURES FOR MISCIBLE DISPLACEMENT PROBLEMS IN POROUS MEDIA Summary Report
Richard E. Ewing Mar. 1979 44 p refs
(Grant NSF MCS-78-09525)
(AD-A070194; MRC-TSR-1934) Avail: NTIS HC A03/MF A01 CSCL 12/1

A model system of equations which has been used to describe the miscible displacement of one incompressible fluid by another in a porous medium is the coupled quasilinear system. Iteractive methods are presented and analyzed which are based on using a preconditioned conjugate gradient iteration for approximately solving the systems of linear equations produced at each time step by Galerkin methods for time-stepping the above system. Optimal order convergence rates are obtained for the iterative methods. The iterative methods are computationally more efficient than Galerkin methods previosuly proposed to solve the above system. The use of different time increments in the time-stepping procedures for the different variables is also presented and analyzed. The use of unequal time increments takes advantage of different smoothnesses in time of the physical variables p and c and greatly reduces the work done in the computation of the approximate solution. GRA

N79-32036# Wisconsin Univ. - Madison. Mathematics Research Center.
THE CONTINUOUS DEPENDENCE ON PSI OF SOLUTIONS OF U SUB T - DELTA PSI(U) = 0
Philippe Benilan and Michael G. Crandall Mar. 1979 25 p refs
(Contract DAAG29-75-C-0024; Grant NSF MCS-78-01245)
(AD-A070179; MRC-TSR-1942) Avail: NTIS HC A02/MF A01 CSCL 12/1

The initial-value problem for equations of the form u sub t-delta psi u = o where psi: R yields R is nondecreasing arises in many contexts. The main results of this paper concern the continuity of the solutions of this initial-value problem as a function of psi. Depending on the behavior of psi near zero, one finds either that the solutions are continuous as a function of psi or into a weaker space. A variety of auxiliary results are proved and the sharpness of the condition which distinguishes between the above cases is established. GRA

N79-32037# Maryland Univ., College Park. Inst. for Physical Science and Technology.
FINITE ELEMENT METHOD FOR THE TRICOMI PROBLEM
A. K. Aziz, M. Schneider (Techn. Univ., Berlin), and A. Werschulz Jun. 1978 14 p refs
(Contract EY-76-S-05-3443)
(ORO-3443-77; BN-883) Avail: NTIS HC A02/MF A01

The numerical solution of a class of equations of elliptic-hyperbolic type by the finite element method is considered; specifically of interest are equations of the form Lu = k(y)u/sub

xx/ + u/sub yy/ = f. A Galerkin formulation motivated by the well-known energy-integral method is used to obtain the fundamental inequality. Then, the finite element formulation of the boundary-value problem is given, and the paper concludes with an error analysis for the procedure. The method can be applied to any well-posed problem of mixed type. DOE

N79-32038# California Univ., Berkeley. Lawrence Berkeley Lab.
NUMERICAL ALGORITHMS IN CHEMISTRY: ALGEBRAIC METHODS, WORKSHOP
Cleve Moler, ed. and I. Shavitt, ed. 9 Aug. 1978 167 p refs Workshop held in Berkeley, Calif., 9-11 Aug. 1978
(Contract W-7405-eng-48)
(LBL-8158; Conf-780878) Avail: NTIS HC A08/MF A01

Computational methods for application to chemical problems are described. Specific topics covered include eigenvalue problems, linear systems of equations, and integral transformations. K.L.

N79-32039# Argonne National Lab., Ill.
FORMULATION AND APPLICATION OF A SOURCE FINDING ALGORITHM
R. J. Yamartino and D. J. Lamich 1979 7 p refs Presented at 4th Symp. of Turbulence, Diffusion, and Air Pollution, Boston, 15-18 Jan. 1979
(Contract W-31-109-eng-38)
(CONF-790142-2) Avail: NTIS HC A02/MF A01

A formalism was developed for utilizing data obtained from an air quality monitoring network to determine the locations and strengths of those sources contributing most significantly to the observed concentrations. The algorithm for determining source location and strength is given and discussed. Application of this algorithm to a large data base has indicated its ability to identify actual source locations and strengths. Approximate solutions, while more economical, seem only capable of locating the largest of the sources and thus, seem inadequate except in unusually simple situations where each receptor concentration measurment is clearly dominated by the presence of a single source. DOE

N79-32040# Brookhaven National Lab., Upton, N. Y.
TIME DEPENDENT MULTI-GRID NUMERICAL TECHNIQUE
H. N. Lee and R. E. Meyers Mar. 1979 13 p refs Presented at the 2nd Intern. Conf. on Comp. Methods in Nonlinear Mech., Austin, Tex., 26 Mar. 1979
(Contract EY-76-C-02-0016)
(BNL-25930; Conf-790311-3) Avail: NTIS HC A02/MF A01

An introduction to the implementation of the multigrid method in the solution of time-dependent partial differential equations is presented. Multigrid solution for the advection equation are compared with published results using the usual fixed grid method. DOE

N79-32041# Northwestern Univ., Evanston, Ill.
PROBABILISTIC ERROR ANALYSIS OF COMPUTER ARITHMETICS
E. H. Bareiss and J. L. Barlow Dec. 1978 102 p refs
(Contract EY-76-S-02-2280)
(COO-2280-37) Avail: NTIS HC A06/MF A01

The problem of continuous and discrete error distribution for real computer arithmetics is discussed. The literature is surveyed and several important theorems are proven. Topics considered include fixed and floating point arithmetic, rounding off, and logarithmic computers. DOE

N79-32042# Illinois Univ., Urbana. Dept. of Computer Science.
MULTIRATE ORDINARY DIFFERENTIAL EQUATION INTEGRATOR M.S. Thesis
A. Orailoglu Mar. 1979 39 p
(Contract EY-76-S-02-2383)
(COO-2383-0056; UILU-ENG-1704) Avail: NTIS HC A03/MF A01

A multirate integrator is presented and different schemes are tested. The implemented multirate integrator is applied to a variety of test problems, and experimental results are plotted. These show the possibility of large efficiency gains in using multirate methods for a variety of systems of ordinary differential equations. DOE

N79-32043# Sandia Labs., Albuquerque, N. Mex.
LIPSCHITZ CONSTANTS AND ROBUST ODE CODES
L. F. Shampine 1979 32 p refs Presented at 2d Intern. Conf. on Comp. Meth. in Nonlinear Mech., Austin, Tex., 26 Mar. 1979
(Contract EY-76-C-04-0789)
(SAND-79-0458; Conf-790311-2) Avail: NTIS HC A03/MF A01

Estimates of local Lipschitz constants can be computed cheaply with Adams and Runge-Kutta methods. ODE codes can be made more robust with this information by helping the user know if his problem is correctly formulated, if he is using the right kind of method, and if the method is being applied in a reliable way. DOE

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N79-32044# Michigan Univ., Ann Arbor. Dept. of Statistics.
STATISTICAL INFERENCE WITH DELAYED DATA Final Report
Norman Starr and Michael B. Woodroofe Apr. 1979 12 p refs
(Grant DAAG29-76-G-0302)
(AD-A069305; UMICH-014538; ARO-13950.1-M) Avail: NTIS HC A02/MF A01 CSCL 12/1

Problems of inference from data accumulating at the random times when new species are discovered, were studied. Procedures for estimating a variety of characteristics of the population and for predicting the random probability that a next search will uncover a new species were developed. A death process was interposed and estimates of the size of a population and the mean life of its members were obtained. Results for a one-armed bandit in the presence of concomitant information were developed. These results apply to the sequential allocation of treatments in medical trials. Optimal and adaptive stopping based on the maximum of a sequence of dependent observations were studied. The results are likely to have application to the choice of components in redundant systems and to adaptive quality control. Methods have been derived to estimate the true significance level resulting from repeated significance tests. GRA

N79-32045# Clemson Univ., S.C. Dept. of Mathematical Sciences.
A BAYES SEQUENTIAL PROCEDURE FOR SELECTING THE MOST PROBABLE MULTINOMIAL EVENT
James T. Ramey, Jr. and Khursheed Alam Oct. 1978 16 p refs Prepared in cooperation with Francis Marion Coll., Florence, S. C.
(Contract N00014-75-C-0451; NR Proj. 042-271)
(AD-A069455; N100; TR-293) Avail: NTIS HC A02/MF A01 CSCL 12/1

This paper deals with a Bayes sequential sampling procedure for selecting the most probable event from a multinomial distribution whose parameters are distributed a priori according to a Dirichlet distribution. The given rule is compared with other sampling rules which have been considered in the literature. GRA

N79-32046# Union Coll., Schenectady, N.Y. Inst. of Administration and Management.
A USEFUL APPROXIMATE FORMULA FOR THE DETERMINATION OF THE REGIONS OF THE SEQUENTIAL TEST FOR THE CORRELATION COEFFICIENT Technical Report, Jun. 1978 - Jan. 1979
Leo A. Aroian and Robert W. Miller (Allied Chemical Co., Buffalo) 15 Feb. 1979 13 p refs
(Contract N00014-77-C-0438)
(AD-A069820; AES-7901) Avail: NTIS HC A02/MF A01 CSCL 12/1

A simple approximate formula is shown to be remarkably

accurate for the determination of the regions of the sequential test for the correlation coefficient, rho, when the variates follow a bivariate normal distribution. The approximate results are compared with the exact values and with an approximation of Ghosh (1970). The exact results depend on the solution of an equation involving the ratio of two hypergeometric functions. These results, combined with the Monte Carlo evaluations of the OC, operating characteristic function, the ASN, the average sample number, and the exact values of some selected regions provide all the materials needed for this sequential test. The real advantage of a sequential test over a fixed size test is the early termination of the test when rho exceeds or rho sub 1 or rho is less than rho sub 0 by a substantial amount. Additionally the savings in sample size vary from 25% to 80% as compared to a fixed size test. GRA

N79-32047# Illinois Univ. at Urbana-Champaign.
A RECURSIVE ESTIMATION ALGORITHM FOR DISCRETE-TIME SYSTEMS WITH UNKNOWN NOISE PARAMETERS M.S. Thesis
Nathan Guedalia Sep. 1978 58 p refs
(Contract DAAB07-72-C-0259)
(AD-A069794; R-821; UILU-ENG-78-2214) Avail: NTIS HC A04/MF A01 CSCL 09/4

The purpose of this report is to develop a recursive algorithm for state estimation for systems with uncertain models. The algorithm uses a combined detection-estimation scheme whereby the set in which the uncertainties are contained is detected, and appropriate estimator is then used. The approach used is an extension of a weighted minimax performance criteria to the dynamic case. Since global optimal solution is not possible, an approximate algorithm is derived which only optimizes the stage-by-stage performance without changing any past decisions. The expressions for the algorithm and an approximation of its performance are derived. GRA

N79-32048# Illinois Univ. at Urbana-Champaign. Coordinated Science Lab.
ESTIMATION FOR UNCERTAIN LINEAR SYSTEMS WITH JUMP PARAMETERS Ph.D. Thesis
Jitendra Kumar Tugnait Sep. 1978 143 p refs
(Contract DAAB07-72-C-0259; Grant DAAG29-76-G-0154)
(AD-A069769; R-825; UILU-ENG-78-2218) Avail: NTIS HC A07/MF A01 CSCL 12/1

The problem of state estimation for a class of linear discrete-time dynamical systems with unknown time-varying parameters is investigated. Attention is focused mainly on systems with unknown noise statistics. Two different approaches to modelling and estimation under time-varying uncertainties are investigated. In one of the approaches, a finite state Markov chain model is used for the jump parameters which can take values only from a finite set with transitions from one value to another determined by a Markov transition probability matrix. The transition matrix may or may not be known; if unknown, it is assumed to belong to a finite set. A Bayes optimal solution is obtained in a recursive form and several suboptimal algorithms are discussed to alleviate the large storage and computation requirements of the optimal estimator. The asymptotic behavior of the optimal solution for the case of unknown transition probabilities is analyzed. In the second approach, multiple bounds on the unknown parameter values and its time derivatives are assumed to be available. A detection-estimation approach is proposed for state estimation and its asymptotic behavior is analyzed. The main objective of the proposed approach is to reduce the pessimism of the standard minimax estimator for large observation records and large uncertainties, while retaining its desirable small-sample properties. GRA

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

No abstracts in this category.

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N79-32049# Wisconsin Univ. - Madison. Dept. of Statistics.
DESIGN PROBLEMS FOR OPTIMAL SURFACE INTERPOLATION
Charles A. Micchelli and Grace Wahba May 1979 11 p refs Prepared in cooperation with IBM, Yorktown Heights, N.Y.
(Contract N00014-77-C-0675)
(AD-A070012; UWIS-DS-79-565) Avail: NTIS HC A02/MF A01 CSCL 12/1

We consider the problem of interpolating a surface given its values at a finite number of points. We place a special emphasis on the question of choosing the location of the points where the function will be sampled. Using minimal norm interpolation in reproducing kernel Hilbert spaces, equivalently Bayesian interpolation, and N-widths, we provide lower bounds for interpolation error relative to certain error criteria. These lower bounds can be used when evaluating an existing design, or when attempting to obtain a good design by iterative procedures to decide whether further minimization is worthwhile. The bounds are given in terms of the eigenvalues of a relevant reproducing kernel and the asymptotic behavior of these eigenvalues for certain tensor product spaces in the unit d-dimensional cube is obtained. GRA

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

No abstracts in this category.

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N79-32050 British Broadcasting Corp., Kingswood (England). Research Dept.
A PRELIMINARY INVESTIGATION INTO THE MEASUREMENT OF TIME AND FREQUENCY RESPONSE OF LISTENING ROOMS AND CONTROL CUBICLES
R. Walker May 1979 21 p refs
(BBC-RD-1979/9) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

The effects of 'early' reflections in a room on the perceived sound quality from loudspeakers are discussed, with particular reference to small rooms. One method of describing the overall acoustic of any room is by measuring the sound pressure level at a prescribed listening position as a function of both time and frequency. A number of techniques for obtaining this three-dimensional response are described and results presented for two rooms using one of these techniques. The techniques are relatively simple in principle and meaningful results can be obtained down to a lower frequency limit which is equal to the required time resolution. However, the interpretation of the results so obtained is not apparent and it is likely that the variability in the detail of the results is larger than those features representing significant acoustic differences. M.M.M.

N79-32051*# Bolt, Beranek, and Newman, Inc., Canoga Park, Calif.
EVALUATION OF AERO COMMANDER PROPELLER ACOUSTIC DATA: TAXI OPERATIONS
A. G. Piersol, E. G. Wilby, and J. F. Wilby Jun. 1979 130 p refs
(Contract NAS1-14611)
(NASA-CR-159124) Avail: NTIS HC A07/MF A01 CSCL 20A

The acoustic data from ground tests performed on an Aero Commander propeller driven aircraft are analyzed. An array of microphones flush mounted on the side of the fuselage were used to record data. The propeller blade passage noise during operations at several different taxi speeds is considered and calculations of the magnitude and phase of the blade passage tones, the amplitude stability of the tones, and the spatial phase and coherence of the tones are included. The measured results are compared to theoretical predictions for propeller noise and various evaluations which reveal important details of propeller noise characteristics are presented. A.W.H.

N79-32052*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
AN EXPERIMENTAL INVESTIGATION OF TRAILING-EDGE NOISE
T. F. Brooks and T. H. Hodgson (North Carolina State Univ.) Jun. 1979 9 p refs
(NASA-TM-80134) Avail: NTIS HC A02/MF A01 CSCL 20A

Airfoil trailing-edge noise up to a Reynolds number based on chord of 2.96 x 10 to the 6th power was studied. Comparisons are made with current theory, particularly with regard to the nature of the pressure field in the vicinity of the trailing-edge and its influence on the radiated noise. A.R.H.

N79-32053*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ACOUSTICAL PROPERTIES OF HIGHLY POROUS FIBROUS MATERIALS
Robert F. Lambert Jul. 1979 68 p refs
(NASA-TM-80135) Avail: NTIS HC A04/MF A01 CSCL 20A

Highly porous, fibrous bulk sound absorbing materials are studied with a view toward understanding their acoustical properties and performance in a wide variety of applications including liners of flow ducts. The basis and criteria for decoupling of acoustic waves in the pores of the frame and compressional waves in the frame structure are established. The equations of motion are recast in a form that elucidates the coupling mechanisms. The normal incidence surface impedance and absorption coefficient of two types of Kevlar 29 and an open celled foam material are studied. Experimental values and theoretical results are brought into agreement when the structure factor is selected to provide a fit to the experimental data. A parametric procedure for achieving that fit is established. Both a bulk material quality factor and a high frequency impedance level are required to characterize the real and imaginary part of the surface impedance and absorption coefficient. A derivation of the concepts of equivalent density and dynamic resistance is presented. A.W.H.

N79-32054*# Boeing Vertol Co., Philadelphia, Pa.
STUDY OF DESIGN CONSTRAINTS ON HELICOPTER NOISE
Harry Sternfeld, Jr. and Carl W. Wiedersum Jul. 1979 91 p refs
(Contract NAS1-15226)
(NASA-CR-159118) Avail: NTIS HC A05/MF A01 CSCL 20A

A means of estimating the noise generated by a helicopter main rotor using information which is generally available during the preliminary design phase of aircraft development is presented. The method utilizes design charts and tables which do not require an understanding of acoustical theory or computational procedures in order to predict the perceived noise level, a weighted sound pressure level, or C weighted sound pressure level of a single hovering rotor. A method for estimating the effective perceived noise level in forward flight is also included. In order to give the designer an assessment of the relative rotor performance, which may be traded off against noise, an additional chart for estimating the percent of available rotor thrust which must be expended in lifting the rotor and drive system, is included as well as approach for comparing the subjective acceptability of various rotors once the absolute sound pressure levels are predicted. A.R.H.

N79-32055*# Kansas Univ. Center for Research, Inc., Lawrence.
ACOUSTIC PLANE WAVES NORMALLY INCIDENT ON A CLAMPED PANEL IN A RECTANGULAR DUCT
Hillel Unz and Jan Roskam Aug. 1979 130 p refs
(Grant NsG-1301)
(NASA-CR-162278; KU-FRL-417-11) Avail: NTIS HC A07/MF A01 CSCL 20A

The theory of acoustic plane wave normally incident on a clamped panel in a rectangular duct is developed. The coupling theory between the elastic vibrations of the panel (plate) and the acoustic wave propagation in infinite space and in the rectangular duct is considered. The partial differential equation which governs the vibration of the panel (plate) is modified by adding to its stiffness (spring) forces and damping forces, and the fundamental resonance frequency and the attenuation factor are discussed. The noise reduction expression based on the theory is found to agree well with the corresponding experimental data of a sample aluminum panel in the mass controlled region, the damping controlled region, and the stiffness controlled region. All the frequency positions of the upward and downward resonance spikes in the sample experimental data are identified theoretically as resulting from four cross interacting major resonance phenomena: the cavity resonance, the acoustic resonance, the plate resonance, and the wooden back panel resonance. Author

N79-32056*# Hersh Acoustical Engineering, Chatsworth, Calif.
EFFECT OF GRAZING FLOW ON THE ACOUSTIC IMPEDANCE OF HELMHOLTZ RESONATORS CONSISTING OF SINGLE AND CLUSTERED ORIFICES Final Report
Alan S. Hersch and Bruce Walker Aug. 1979 183 p refs
(Contract NAS3-19745)
(NASA-CR-3177) Avail: NTIS HC A09/MF A01 CSCL 20A

A semiempirical fluid mechanical model is derived for the acoustic behavior of thin-walled single orifice Helmholtz resonators in a grazing flow environment. The incident and cavity sound fields are connected in terms of an orifice discharge coefficient whose values are determined experimentally using the two-microphone method. Measurements show that at high grazing flow speeds, acoustical resistance is almost linearly proportional to the grazing flow speed and almost independent of incident sound pressure. The corresponding values of reactance are much smaller and tend towards zero. For thicker-walled orifice plates, resistance and reactance were observed to be less sensitive to grazing flow as the ratio of plate thickness to orifice diameter increased. Loud tones were observed to radiate from a single orifice Helmholtz resonator due to interaction between the grazing flow shear layer and the resonator cavity. Measurements showed that the tones radiated at a Strouhal number equal to 0.26. The effects of grazing flow on the impedance of Helmholtz resonators consisting of clusters of orifices was also studied. In general, both resistance and reaction were found to be virtually independent of orifice relative spacing and number. These findings are valid with and without grazing flow. Author

N79-32057*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
EVALUATION OF A VORTEX MODEL OF TURBULENT CAVITY FLOW
Jay C. Hardin and P. J. W. Block Sep. 1979 47 p refs
(NASA-TP-1505; L-12684) Avail: NTIS HC A03/MF A01 CSCL 20A

A two dimensional discrete vortex model is applied to turbulent flow over a cavity at a Reynolds number based on cavity half length of approximately 500,000. These model predictions are compared with experimental data on a time average and on a spectral basis. The comparisons indicate that the vortex model reproduces the mean velocity profiles of this complex flow, while the turbulent intensity and Reynolds stress profiles are overpredicted in magnitude. Spectral analyses show that the vortex model introduces unrealistic low frequency power which becomes less dominant as the model becomes more disordered. The spectral power distribution of the model in this state is nearly in agreement with that of the data, somewhat too low at the higher frequencies and too high at the lower frequencies. The model is shown to be capable of reproducing the cavity feedback oscillation phenomenon. A.W.H.

N79-32058# Idaho National Engineering Lab., Idaho Falls.
DOPPLER EFFECT MEASUREMENTS ON SOLID AND LIQUID Sn
F. Y. Tsang and R. M. Brugger 1978 7 p refs Presented at the ANS Ann. Meeting, Atlanta, 3 Jun. 1979 Prepared in cooperation with Missouri Univ., Columbia
(Contract EY-76-C-07-1570)
(CONF-790602-41) Avail: NTIS HC A02/MF A01

Neutrons at 24 keV were used to measure the integrated neutron transmission of relatively thick tin samples as a function of thickness and temperature. The effective total cross sections are plotted and discussed as a function of the Doppler effect, temperature resonance self-shielding, and thickness. DOE

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N79-32059# California Univ., Livermore. Lawrence Livermore Lab.
REVIEW OF THE MICROSCOPIC CROSS SECTIONS FOR THE AMERICIUM ISOTOPES IN THE RESOLVED RESONANCE REGION
J. C. Browne 16 Nov. 1978 19 p refs Presented at the Specialist Meeting on Nucl. Data of the Higher Plutonium and Americium Isotopes for Reactor Appl., Upton, N. Y., 20-22 Nov. 1978
(Contract W-7405-eng-48)
(UCRL-81909; Conf-781174-2) Avail: NTIS HC A02/MF A01

The differential cross section measurements for Am-241/Am-242m and Am-243 are reviewed in the energy range from 0.5 eV to 10 keV. Parameters extracted from resonance analysis, such as the neutron strength function, the average level spacing, the average capture and fission widths, are compared for the various measurements. The average capture and fission cross sections from 100 eV to 10 keV are directly compared. The status of the data set is discussed with suggestions for further measurements. DOE

N79-32060# Wisconsin Univ., Madison. Dept. of Nuclear Engineering.
INELASTIC MOLECULAR COLLISIONS: APPLICATIONS OF THEORETICAL METHODS TO PROBLEMS IN RELAXATION PHENOMENA, LASER OPERATION, AND COMBUSTION KINETICS Progress Report, 1 Feb. - 1 Nov. 1978
R. W. Conn 1978 36 p refs
(Contract EY-76-S-02-2555)
(COO-2555-T1) Avail: NTIS HC A03/MF A01

Practical theoretical methods are developed and implemented for handling molecular collision problems and subsequently a study was made of the important processes which influence collision rates and a computation made of rate information suitable for gas laser and combustion kinetics modeling studies. The study focuses on CO and HF molecules, which are of practical interest as molecular lasers and of theoretical interest for discerning the role of rotation processes in vibrational relaxation. DOE

N79-32061# Brown Univ., Providence, R. I.
SEARCH FOR LONG LIVED HEAVY PARTICLES AND THE PRODUCTION OF ANTI-NUCLEI BY 400 GeV PROTONS
D. Cutts, R. S. Dulude, B. W. Hughlock, R. E. Lanou, J. T. Massimo, A. E. Brenner, D. C. Carey, J. E. Elias, P. H. Carbincius, V. A. Polychronakos et al 1978 13 p refs Presented at 4th European AntiProton Symp., Barr, France, 25 Jun. 1978 Prepared in cooperation with Fermi National Accelerator Lab., Batavia, Ill., Illinois Univ., Urbana, Istituto Nazionale di Fisica Nucleare, Rome, MIT, Cambridge, and Institute of Nuclear Research, Warsaw
(Contract EY-76-C-02-3130)
(COO-3130TB-252; Conf-7806132-2) Avail: NTIS HC A02/MF A01

A high sensitivity search was performed for massive longlived particles produced at 2.5mr by 400 GeV/c protons on a baryllium target using time-of-flight, Cherenkov, and calorimetric techniques. A total of 10 to the 11th power light particles was sampled at 70 GeV/c. This experiment places a limit of 1.1 x 10 to the minus 37th power squared centimeters/(GeV/c) squared/nucleon on the invariant cross section for the production of stable particles in the mass range of 4 to 10 GeV/c squared. As a byproduct of this search the relative production rates are also measured for anti p, anti d, anti t, He-3, and He-4.23 references. DOE

N79-32062# Oak Ridge National Lab., Tenn.
GAMMA-RAY CONTINUUM SPECTRA FROM HEAVY ION REACTIONS
J. R. Beene, M. L. Halbert, D. C. Hensley, D. G. Sarantites, L. W. Westerberg, K. Geoffroy, and R. Woodward 1979 9 p refs Presented at the Symp. on High Spin Phenomena in Nuclei, Argonne, Ill., 15 Mar. 1979 Prepared in cooperation with Washington Univ., Seattle
(Contract W-7405-eng-26)
(CONF-790323-2) Avail: NTIS HC A02/MF A01

A detailed quantitative analysis of the yrast continuum was attempted by subtracting the underlying statistical continuum in a way that makes allowance for ignorance of its detailed shape. This procedure makes it possible to obtain the moment of inertia as a function of spin over a wide range of spins. The results of this continuum spectra shape analysis can be used to calculate the first and second moments of the continuum multiplicity distribution. Continuum spectra were taken during the bombardment of 150 Nd by 115 and 130 MeV beams of 20 Ne, also the first and second moments of the gamma-ray multiplicity distribution as a function of the gamma energy. The moment of inertia versus spin and the deduced yrast continuua are shown. DOE

N79-32063# Argonne National Lab., Ill.
DETERMINATION OF ORBITALS FOR USE IN CONFIGURATION INTERACTION CALCULATIONS
Thomas H. Dunning, Jr., Ernest R. Davidson (Washington Univ.), Klaus Ruedenberg (Iowa State Univ.), and Jurgen Hinze (Bielefeld Univ.) 1978 46 p refs Presented at the Workshop on Study of Post Hartree-Fock: Configuration Interaction, Berkeley, Calif., 14-16 Aug. 1978
(Contract W-31-109-eng-38)
(CONF-780883-1) Avail: NTIS HC A03/MF A01

Methods for determining orbitals for use in configuration interaction calculations are discussed, along with the advantages and disadvantages of each. Techniques considered include Hartree-Fock, generalized valence bond, multiconfiguration self consistent field, and natural orbital methods. K.L.

N79-32064# Sandia Labs., Albuquerque, N. Mex.
ANALYSIS OF COATINGS AND THIN FILMS USING ENERGETIC IONS
J. A. Borders 1979 10 p refs Presented at Intern. Conf. on Met. Coatings, San Diego, Calif., 23 Apr. 1979
(Contract EY-76-C-04-0789)
(SAND-79-2076C; Conf-790442-3) Avail: NTIS HC A02/MF A01

Energetic ion analysis techniques provide nondestructive information on the depth distribution of atomic composition in the near-surface (1 to 10 micron m) region of a solid sample. The techniques are quantitative and are not complicated by the presence of chemical or matrix effects. Generalized nuclear reaction analysis is described and its application to the measurement of the stoichiometry of Ta2O5 films and BeO coatings on Cu-Be is discussed. DOE

N79-32065# Ames Lab., Iowa.
SYSTEMATIC DETERMINATION OF EXTENDED ATOMIC ORBITAL BASIS SETS AND APPLICATION TO MOLECULAR SCF AND MCSCF CALCULATIONS Ph.D. Thesis - Iowa State Univ.
David Francis Feller Jan. 1979 119 p refs
(Contract W-7405-eng-82)
(IS-T-852) Avail: NTIS HC A06/MF A01

The behavior of the two exponential parameters in an even-tempered gaussian basis set is investigated as the set optimally approaches an integral transform representation of the radial portion of atomic and molecular orbitals. This approach

permits a highly accurate assessment of the Hartree-Fock limit for atoms and molecules. DOE

N79-32066# Stanford Linear Accelerator Center, Calif.
QUANTUM CHROMODYNAMICS AND THE DYNAMICS OF HADRONS
S. J. Brodsky Mar. 1979 58 p refs
(Contract EY-76-C-03-0515)
(SLAC-PUB-2298) Avail: NTIS HC A04/MF A01

The application of perturbative quantum chromodynamics (QCD) to the dynamics of hadrons at short distance is reviewed, with particular emphasis on the role of the hadronic bound state. A number of applications are discussed, including the modification to QCD scaling violations in structure functions due to hadronic binding; a discussion of coherence and binding corrections to the gluon and sea-quark distributions; QCD radiative corrections to dimensional counting rules for exclusive processes and hadronic form factors at large momentum transfer; generalized counting rules for inclusive processes; the special role of photon-induced reactions in QCD, especially applications to jet production in photon-photon collisions, and photon production at large transverse momentum. Also presented is a short review of the central problems in large P/sub T/hadronic reactions and the distinguishing characteristics of gluon and quark jets. DOE

N79-32067# Stanford Linear Accelerator Center, Calif.
PARITY VIOLATION IN INELASTIC SCATTERING OF POLARIZED ELECTRONS
C. Y. Prescott Oct. 1978 56 p refs Presented at the 6th Treiste Conf. on Particle Phys., Trieste, Italy, 26 Jun. 1978
(Contract EY-76-C-03-0515)
(SLAC-PUB-2218; Conf-7806134-1) Avail: NTIS HC A04/MF A01

Parity nonconservation was observed in the inelastic scattering of longitudinally polarized electrons from an unpolarized deuterium target at 19.4 and 22.2 GeV. The statistical and systematic errors are each about 9 percent of the measured asymmetry. The result is consistent with predictions from the standard Weinberg-Salam SU(2) x U(1) model. Using the simple quark-parton model of the nucleon, the value sin 2 theta/sub W/ = 0.20 + or - 0.03 is obtained. DOE

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N79-32068# California Univ., Livermore. Lawrence Livermore Lab.
THREE-DIMENSIONAL THERMAL ANALYSIS OF A HIGH-LEVEL WASTE REPOSITORY
T. J. Altenbach Apr. 1979 37 p refs
(Contract W-7405-eng-48)
(UCID-17984) Avail: NTIS HC A03/MF A01

The TRUMP computer code was used to evaluate the thermal fields for six repository scenarios that studied the effects of room ventilation, room backfill, and repository thermal diffusivity. The results for selected nodes are presented as plots showing the effect of temperature as a function of time. DOE

N79-32069# Department of Energy, Washington, D. C. Office of Nuclear Waste Management.
EARTH SCIENCE TECHNICAL PLAN FOR MINED GEOLOGIC DISPOSAL OF RADIOACTIVE WASTE
Jan. 1979 160 p refs Prepared in cooperation with Geologic Survey, Washington, D. C.
(Contract EW-78-I-08-1543)
(TID-29018-Draft) Avail: NTIS HC A08/MF A01

The various earth science research tasks performed for development of mined geologic repositories for high-level radioactive wastes and/or spent fuel are described and classified. The main technical questions that pertain to the safe isolation of radioactive wastes are listed along with current tasks related to these questions. Program priorities and technical questions that require additional attention are included. DOE

N79-32070# Sandia Labs., Albuquerque, N. Mex.
PROCEEDINGS OF THE SANDIA LABORATORIES WORKSHOP ON THE USE OF TITANATE ION EXCHANGERS FOR DEFENSE WASTE MANAGEMENT
R. L. Schwoebel and C. J. Northrup 29 Sep. 1978 84 p Workshop held at Albuquerque, N. Mex., 25 May 1978
(Contract EY-76-C-04-0789)
(SAND-78-2019) Avail: NTIS HC A05/MF A01

Abstracts and visual aids from the following talks are presented: removal of radionuclides from Hanford defense waste solutions; waste management programs at Savannah River Plant; application of defense waste decontamination; americium and curium recovery from nuclear waste using inorganic ion exchanger materials; removal of trace Ru-106 in nuclear waste processing; and titanate characterization and consolidation processes. Copies of three memos are included: Sr-90 radiation effects on sodium titanate loaded macroreticular resin; Pu-238, 239 content in defense waste; and preparation and physical properties of sodium titanate in ion exchange resin. DOE

N79-32071# Addis Translations International, Portola Valley, Calif.
ENVIRONMENTAL IMPACT OF WASTE MANAGEMENT AND TRANSPORT OF RADIOACTIVE MATERIALS ORIGINATING FROM THE NUCLEAR FUEL CYCLE
Y. Sousselier 15 Mar. 1979 20 p Transl. into ENGLISH from Impact sur l'Environnement de la Gestion des Dechets et des Transports de Matieres Radioactives du Cycle de Combustibles Nucleaires (France), report prepared for the Environment Program of the UN, Sep. 1978 20 p Prepared for Battelle Pacific Northwest Labs., Richland, Wash.
(Contract W-7405-eng-48)
(PNL-TR-355) Avail: NTIS HC A02/MF A01

Transport of radioactive materials originating from operation of the nuclear fuel cycle represents only a limited number of transports at present. Such transports have already been subject to precise, complete, and strict rules for many years. The radioactive impact which transports of radioactive materials have will remain very limited. The impact of accidents will also be very limited. The details study of the various stages of the management of radioactive wastes as it is presently performed and of the techniques which are being developed and will be implemented as nuclear power continues to be developed demonstrates that the potential environmental impacts are presently, and will remain in the future, small if not negligible. DOE

N79-32072# California Univ., Livermore. Lawrence Livermore Lab.
MULTIGAMMA-RAY CALIBRATION SOURCES
R. A. Meyer 1 Dec. 1978 55 p refs
(Contract W-7405-eng-48)
(M-100) Avail: NTIS HC A04/MF A01

Tables are presented for the results of measurement and analysis of a primary and secondary set of multigamma-ray calibration sources that were developed and found useful. Some multi-gamma ray source values are also included. DOE

N79-32073# Los Alamos Scientific Lab., N. Mex.
KAON INTERACTIONS WITH VERY LIGHT NUCLEI
B. F. Gibson 1979 12 p refs Presented at the 2nd Intern. Conf. on Meson-Nucl. Phys., Houston, Tex., 5-8 Mar. 1978
(Contract W-7405-eng-36)
(LA-UR-79-653; Conf-790347-1) Avail: NTIS HC A02/MF A01

Low energy kaon interactions (both K and anti K) with very light nuclei are reviewed. Limitations upon present K-nucleus studies due to uncertainties in the K-N amplitudes are emphasized along with promising uses. A brief review of some of the many interesting aspects of anti K-nucleus scattering is given. Comparison of the limited anti K-d and anti K-He-4 elastic data with theory is made. The anti Kd yields pi Lambda p reaction is discussed including the possible Sigma N virtual bound state. DOE

N79-32074# California Univ., Berkeley. Lawrence Berkeley Lab.
REACTIVE AND NONREACTIVE SCATTERING OF MODULATED MOLECULAR BEAMS FROM WELL CHARACTERIZED PLATINUM SINGLE CRYSTAL SURFACES Ph.D. Thesis
R. J. Gale Dec. 1978 150 p refs
(Contract W-7405-eng-48)
(LBL-7687) Avail: NTIS HC A07/MF A01

Gas-surface interactions were studied by modulated molecular beam mass spectrometry on Pt(111) and stepped Pt(111) surfaces under ultra-high vacuum conditions. The angular distribution of helium atoms scattered from the stepped Pt(553) surface was measured as a function of the angle of incidence. Rainbow scattering was observed indicating that the ordered array of steps and terraces exhibits a strongly periodic surface potential. The angular distribution of scattered helium atoms exhibits a sharp peak at the specular angle, characteristic of a smooth and well ordered surface. The H2-D2 exchange reaction on the Pt(111) and the two stepped surfaces, Pt(553) and Pt(332) and the mechanism of the H2-D2 exchange reaction on the Pt(111) and stepped Pt(332) surfaces are examined. DOE

N79-32075# Atomics International Div., Richland, Wash. Rockwell Hanford Operations.
SPENT FUEL HANDLING AND PACKAGING PROGRAM
Sep. 1978 24 p refs
(Contract EY-77-C-06-1030)
(RHO-LD-78-4-SEP) Avail: NTIS HC A02/MF A01

The objective is to design, develop, and demonstrate a spent fuel package for geologic storage and disposal; to design, license, and construct the facilities to produce this package; and to develop and demonstrate technology for the dry, passive surface storage of spent fuel. Progress is reported on engineering and system studies, technical R and D studies, demonstrations, project support studies, spent fuel facility project, and program management. DOE

N79-32076# Washington Univ., Seattle.
HIGH ENERGY PHYSICS STUDIES OF PARTICLE INTERACTIONS AND THE SEARCH FOR NEW PARTICLES Annual Progress Report, 15 May 1978 - 14 May 1979
J. J. Lord and R. J. Wilkes 13 Feb. 1979 25 p refs
(Contract EY-76-S-05-2225-027)
(RLO-2225-T27-10) Avail: NTIS HC A02/MF A01

Continued effort was directed to the study of multiparticle production processes in nuclei. Photons were used as the projectile; within the last two years, cascades produced by projectiles having quite different mean-free-paths in nuclear matter were investigated. An experiment was performed to search for new particles produced by neutrino interactions in nuclear emulsion targets located inside the bubble chamber. The experiment is a collaborative effort involving U.S., Polish and Soviet groups. A unique opportunity to compare and contrast leptoproduction and hadroproduction is made available. Also continued is an analysis of nucleus-nucleus interactions from heavy ion beams. DOE

N79-32077# Department of Energy, Washington, D. C.
HYBRID THERMONUCLEAR REACTOR CONFIGURATION DRIVEN BY A RELATIVISTIC ELECTRON BEAM AND HAVING A LIQUID FIRST WALL
Ye. V. Muravev, S. L. Nedoseyev, P. V. Romanov, L. I. Rudakov, V. D. Ryutov, Y. A. Tsygankov, and G. Y. Shatalov 1978 27 p refs Transl. into ENGLISH from Russian report
(DOE-tr-166) Avail: NTIS HC A03/MF A01

A thermonuclear reactor which operates with a relatively low microexplosion repetition rate, approximately 0.1 Hz., for a time averaged thermonuclear power yield of 10 to the 9th power is presented. The action of a microexplosion on the initial wall and the blanket are some of the features discussed in the reactor configuration. The thermal stresses which arise in the condensed matter where it is irradiated by a pulsed, intense neutron flux are examined. A.W.H.

N79-32078# California Univ., Livermore. Lawrence Livermore Lab.
SITE SUITABILITY CRITERIA FOR SOLIDIFIED HIGH LEVEL WASTE REPOSITORIES
Richard A. Heckman, Thomas Holdsworth, Dana Isherwood, Donald F. Towse, and Nadia L. Dayem (NRC) 3 Apr. 1979 197 p refs
(Contract W-7405-eng-48)
(UCID-17831) Avail: NTIS HC A09/MF A01

A framework of regulations, criteria, and standards for nuclear waste management is discussed. An analysis for site suitability for waste disposal is conducted. The high level waste and interim storage, transportation to the repository site, handling and emplacement of the repository until the repository is sealed, and the future history of the sealed repository are topics addressed. Geologic events, the effect nuclear waste disposal has on geohydrologic parameters, the modeling of waste transport through the hydrologic system, and the calculation of the associated radiologic risk are examined. A.W.H.

N79-32079# Du Pont de Nemours (E. I.) and Co., Aiken, S. C. Savannah River Lab.
EVALUATION OF GLASS AS A MATRIX FOR SOLIDIFYING SAVANNAH RIVER PLANT WASTE: PROPERTIES OF GLASSES CONTAINING Li2O
M. J. Plodinec and J. R. Wiley Feb. 1979 41 p refs
(Contract EY-76-C-09-0001)
(DP-1498) Avail: NTIS HC A03/MF A01

Properties of waste forms made of borosilicate glass containing Li2O combined with both simulated and actual Savannah River Plant (SRP) waste sludges were studied. The glass former, Frit 21, is presently the leading candidate for vitrifying SRP waste in a proposed process for long-term waste management. Devitrification of waste forms was inhibited by sludge components uranium and nickel, but was promoted by aluminum. Devitrification increased the leach rate of waste forms containing simulated sludges up to a factor of 20 in high-temperature leach tests and could be qualitatively correlated with the leach rate of waste forms containing actual sludges in room temperature tests. Room temperature leach rates were diffusion controlled throughout a 100-day test. Although sulfate solubility in Frit 21-sludge melts could be raised from 1 wt % to 2.5 wt % by slight modifications of the frit, this should not be necessary since Na2SO4 washes from actual sludges to levels below 0.5 wt %. DOE

N79-32080# Atomics International Div., Richland, Wash.
SPENT FUEL HANDLING AND PACKAGING PROGRAM Summary Report
Dec. 1978 22 p
(Contract EY-77-C-06-1030)
(RHO-LD-78-4-JUL) Avail: NTIS HC A02/MF A01

Topics discussed include the completion of the 70% draft of spent fuel handling and packaging facility conceptural design report; the spent fuel package delivery criteria and work plan for support of the near surface test facility; the preparation of revised functional design criteria for the spent fual facility; and development of fixed site and variable site transportation logistics models. DOE

N79-32081# Atomics International Div., Richland, Wash. Rockwell Hanford Operations.
SPENT FUEL HANDLING AND PACKAGING PROGRAM Management Summary Report, Aug. 1978
Dec. 1978 23 p
(Contract EY-77-C-06-1030)
(RHO-LD-78-4-AUG) Avail: NTIS HC A02/MF A01

The program has the objective to design, develop, and demonstrate a spent fuel package for geologic storage and disposal and design, license, and construct the facilities to produce this package, and to develop and demonstrate technology for the dry, passive surface storage of spent fuel. A 90% complete draft of the Spent Fuel Receiving and Packaging Facility conceptual design report was completed. The construction work at the Nevada Test Site, in support of the 1978 Spent Fuel Demonstration was restarted. DOE

N79-32082# Argonne National Lab., Ill.
PURE SPIN TOTAL CROSS SECTIONS
H. Spinka 1978 19 p refs Presented at the 3d Intern. Symp. on Phys. with Polarized and Target Beams, Argonne, Ill., 23 Oct. 1978
(Contract W-31-109-eng-38)

(CONF-7810119-1) Avail: NTIS HC A02/MF A01

Measurements of the pure spin total cross sections in the NN system are described. Evidence for a dibaryon resonance interpretation of the structure in the I = 1 cross sections at P/sub LAB/ less than or approximately equal to 3 GeV/c is discussed. Data on the total cross section difference for longitudinal beam and target in the I = 0 system are presented. DOE

N79-32083# Oak Ridge National Lab., Tenn.
NEW GIANT RESONANCES: AN EXPERIMENTAL REVIEW
F. E. Bertrand 1978 61 p refs
(Contract W-7405-eng-26)
(TID-29394) Avail: NTIS HC A04/MF A01

Data and interpretation rather than experimental methods are emphasized in a discussion of the nondipole giant resonances, and electric monopoles. Direct observations of giant resonance arising through inelastic scattering are described. Graphs are given of the various angular distributions, cross sections, and spectra. DOE

N79-32084# Atomics International Div., Richland, Wash.
SPENT FUEL HANDLING AND PACKAGING PROGRAM Summary Report
Dec. 1978 22 p
(Contract EY-77-C-06-1030)
(RHO-LD-78-4-JUN) Avail: NTIS MF A02/MF A01

The program objective is to design, construct, and license a Spent Fuel Packaging Facility. Examination of the first PWR fuel assembly for use in the dry surface storage demonstration was completed. A quality assurance plan was issued for the construction of the Sealed Storage Cask concrete shield at the Nevada Test Site, and also issued was a prelimminary draft of section 7.5 Environmental Assessment, of the Spent Fuel Facility Conceptual Design Report. DOE

N79-32085# Oak Ridge National Lab., Tenn.
ROLE OF MATHEMATICAL MODELING IN LOW-LEVEL RADIOACTIVE WASTE MANAGEMENT
D. S. Ward, D. D. Huff, and L. D. Eyman 1979 14 p refs Presented at Waste Management Seminar, Oak Ridge, Tenn., 6 Mar. 1979
(Contract W-7405-eng-26)
(CONF-790331-2) Avail: NTIS HC A02/MF A01

With increased experience in shallow land burial of radioactive wastes, there is general recognition of the need for improved practices to reduce the release of radioactivity to the biosphere. One approach is to use mathematical models to gain insights into the impact of possible preventive and corrective engineering measures. Two deterministic models of hydrologic processes were examined. On a watershed scale, a unified hydrologic model has been applied to the White Oak Creek Watershed in Oak Ridge, Tennessee. Comparison of predicted and observed streamflow at the basin outlet are favorable. The model applied to evaluate the consequences of a disposal area development, operation, and management; including clear-cutting of forested areas, installing near-surface infiltration-reduction seals, and surface water diversion channels. On a localized scale, a near-surface infiltration-reduction seal was studied using a finite-element model for subsurface flow. DOE

N79-32086# Battelle Pacific Northwest Labs., Richland, Wash.
PHYSICAL MODELING OF JOULE HEATED CERAMIC GLASS MELTERS FOR HIGH LEVEL WASTE IMMOBILIZATION
M. S. Quigley and D. K. Kreid Mar. 1979 159 p refs
(Contract EY-76-C-06-1830)
(PNL-2809) Avail: NTIS HC A08/MF A01

It was not shown that the isothermal boundary conditions imposed by this study established prototypic heat losses through the boundaries of the model. Prototype wall temperatures and heat fluxes should be measured to provide better verification of the accuracy of the physical model. A complete set of measurements covering power input, heat balances, wall temperatures, glass temperatures, and glass properties should be attempted for at least one prototype run. The information could be used to verify both physical and analytical models. Particle settling and/or sludge buildup should be studied directly by observing the accumulation of the appropriate size and density particles during feeding in the physical model. New designs should be formulated and modeled to minimize the potential problems with melter operation identifed by this study. DOE

N79-32087# Los Alamos Scientific Lab., N. Mex.
GENERAL-PURPOSE HEAT SOURCE PROJECT, SPACE NUCLEAR SAFETY PROGRAM, AND RADIOISOTOPIC TERRESTRIAL SAFETY PROGRAM Progress Report
R. D. Baker, comp. Aug. 1978 36 p
(Contract W-7405-eng-36)
(LA-7460-PR) Avail: NTIS HC A03/MF A01

The use of (Pu-238)O2 in radioisotopic power systems is considered. General purpose heat source development, space nuclear safety, and radioisotopic terrestrial safety are among the topics discussed. A.W.H.

N79-32088# Battelle Memorial Inst., Columbus, Ohio. Office of Nuclear Waste Isolation.
NATIONAL WASTE TERMINAL STORAGE PROGRAM: OFFICE OF NUCLEAR WASTE ISOLATION TECHNICAL PROGRAM PLAN. VOLUME 1: TECHNICAL OVERVIEW
16 Feb. 1979 120 p
(Contract EY-76-C-06-1830)
(ONWI-19) Avail: NTIS HC A06/MF A01

A technical program plan was developed detailing projected activities toward the development and operation of a geologic waste repository. The overall program is presented im summary fashion showing objectives, technical scope, technical approach, schedule plan, FY 1979 budget and milestone plan, organization, management processes, and nuclear waste isolation issues. DOE

N79-32089# Atomics International Div., Richland, Wash.
SPENT FUEL STORAGE AND ISOLATION
M. S. Bensky, W. J. Kurzeka, A. A. Bauer, J. A. Carr, and S. C. Matthews Feb. 1979 23 p refs Presented at the Symp. on Waste Management and Fuel Cycles, Tucson, Ariz., 28 Feb. 1979 Prepared in cooperation with Battelle Memorial Inst., Columbus, Ohio
(Contract EY-77-C-06-1030)
(RHO-SA-102; Conf-790204-5) Avail: NTIS HC A02/MF A01

The principal activities conducted within the commercial waste and spent fuel within the Commercial Waste and Spent Fuel Packaging Program are: simulated near-surface (drywell) storage demonstrations at Hanford and the Nevada Test Site; surface (sealed storage cask) and drywell demonstrations at the Nevada Test Site; and spent fuel receiving and packaging facility conceptual design. These investigations are described. DOE

74 OPTICS

Includes light phenomena.

N79-32090*# National Aeronautics and Space Administration, Washington, D. C.
DATA ON ATMOSPHERIC TRANSMISSION IN THE IR SPECTRAL REGION
N. N. Paramonova, K. V. Kazakova, and A. M. Brounshteyn Aug. 1979 17 p refs Transl. into ENGLISH of "Dannye o propuskanii atmosfery v IK oblasti spektra" Acad. of Sci. USSR, 1979 13 p Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75652) Avail: NTIS HC A02/MF A01 CSCL 20F

The weakening of radiation by the atmosphere in the infrared region of the spectrum was studied. The instrument used for the measurements was the IKAU-1 infrared atmospheric unit, and measurements were carried out both on an inclined path and a near-earth horizontal path. Author

N79-32091# Aeronautical Systems Div., Wright-Patterson AFB, Ohio. Directorate of Avionics Engineering.
DEGRADATION IN FLIR SENSITIVITY DUE TO WINDOW ABSORPTANCE/EMITTANCE Final Report
Douglas W. Amlin Mar. 1979 29 p refs

(AD-A069289; ASD/ENA-79-6) Avail: NTIS HC A03/MF A01 CSCL 17/5

The degradation in the sensitivity of a FLIR as a result of the absorptance and emittance of the infrared window material is considered. An analytical treatment of the problem is presented along with some calculated results for the PAVE TACK system and three possible window materials. GRA

N79-32092# Naval Research Lab., Washington, D. C.
MODEL FOR PREDICTING RELATIVE SIGNAL POWER IN COHERENT ANTI-STOKES RAMAN SPECTROSCOPY
William S. Sanders Apr. 1979 46 p refs
(AD-A069963; NRL-MR-3973) Avail: NTIS HC A03/MF A01 CSCL 20/6

A more general mathematical model has been developed for the prediction of signal power generated by the Coherent Anti-Stokes Raman Scattering process cars. Like previous treatments the model assumes that the laser beams have Gaussian profiles. However, provision is made for varying a number of experimental parameters, either singly or in combinations. In particular, the model allows for non-collinearity of the laser beams, different beam diameters, lateral offset of the beam centers, and relative displacement of the focal points of the beams. Computational time requirements of the new model are not significantly greater than prveious treatments of identical, collinear Gaussian beams, although the numerical integrations must be handled more carefully. GRA

N79-32093# Honeywell, Inc., Minneapolis, Minn. Systems and Research Center.
THERMOELECTRICALLY COOLED FOCAL PLANE FOR NON-SCANNING SYSTEMS Final Report, 6 Jun. 1977 - 6 May 1978
N. A. Foss, M. N. Gurnee, and T. Hendrickson Feb. 1979 228 p
(Contract DAAK70-77-C-0160)
(AD-A068730; HONEYWELL-78SRC71) Avail: NTIS HC A11/MF A01 CSCL 17/5

The objectives of this contract were to analyze potential system applications for 3 to 5 micrometers TE-cooled staring focal planes and to determine both universal and unique focal plane requirements for each of the applications; determine critical detector and focal plane signal processing parameters and develop preliminary designs for these focal planes; evaluate the overall focal plane designs to determine system performance; and make performance measurements on sample detector elements, focal plane electronics, and equalization processing electronics to substantiate predictions of device performance. A tradeoff of staring and scanned array systems showed that tremendous systems performance improvements can be made by using high density staring focal plane arrays. In particular, improved MRT and NE (Delta) T performance, reduced power consumption, lightweight and all electronic operation (no moving parts) are advantages which staring arrays have over scanned arrays. GRA

N79-32094# ITT Electro-Optical Products Div., Roanoke, Va.
ULTRA LOW LOSS OPTICAL FIBER CABLE ASSEMBLIES Semiannual Report, Apr. - Nov. 1978
John C. Smith and Robert E. Thompson May 1979 40 p
(Contract DAAB07-78-C-2922; DA Proj. 1L1-62701-AH-92)
(AD-A069792) Avail: NTIS HC A03/MF A01 CSCL 20/6

This report describes the progress made from April to November, 1978, in the development of Ultra Low Loss Fiber Optic Cable Assemblies for Time Division Multiplexed (TDM). This effort includes the fiber optic cable as well as the connectors needed to terminate them. Optimization of the optical fiber fabrication process is in progress, the objective is to increase the fiber yield against the cable specification. Further ruggedization of the cable is needed in order to achieve the 100% fiber survivability in the impact testing per MIL-C-13777. It is also necessary to keep the excess cabling losses at a minimum. The three sphere connector concept has been selected for full development, and the jeweled ferrule concept as a back up. GRA

N79-32095# Textron Bell Aerospace Co., Buffalo, N. Y.
BEHAVIOR OF INFRARED WINDOW MATERIALS EXPOSED TO RAIN DROP ENVIRONMENTS AT VELOCITIES TO 2000 FPS (610 M/S) Final Report, Jul. 1977 - Sep. 1978
J. Vaughn Hackworth and Lawrence H. Kocher Sep. 1978 166 p refs
(Contract F33615-77-C-5069; AF Proj. 2422)
(AD-A070004; AFML-TR-78-184) Avail: NTIS HC A08/MF A01 CSCL 17/5

The work described in this report builds on, and extends, that performed in the previous investigation. The objectives were to determine the erosion behavior of current infrared window materials, describe the mechanisms and modes of degradation of material properties and identify suitable techniques for development of more erosion resistant materials for future infrared window requirements. In addition to zinc selenide and zinc sulfide, the materials studied included silicon, magnesium fluoride, spinel, and sapphire. These additional four materials are of interest for applications at velocities between Mach 1 and Mach 2. Single drop experiments were performed to determine the damage threshold velocity for all the materials, the effect of impact angle for zinc selenide, the improvement to be gained by reducing the grain size of zinc selenide, the response of antireflection coatings on zinc selenide and gallium arsenides, the performance of bilayered zinc sulfide/zinc selenide specimens and the feasibility of a bimedia protective layer concept. GRA

N79-32096# Rank Optics, Leeds (England).
DESIGN STUDY FOR A FIBER OPTICS BRANCHING COUPLER Final Report
P. S. Cain, N. G. Robertson, and J. M. Russell Sep. 1978 114 p refs
(Contract ESTEC-3340/77-NL-AK(SC))
(RO-978; ESA-CR(P)-1196) Avail: NTIS HC A06/MF A01

Various possibilities for achieving a single fiber T-coupler and a multiline branching coupler for space applications were examined and from those reviewed the most promising types meriting further study were selected. Development models were designed, manufactured, tested, and analyzed. Engineering models of the couplers which were considered to be space qualifiable were prepared. The models, however, were not to be type tested. Drawings of the developed couplers are included. Author (ESA)

N79-31671# Institut d'Astrophysique, Cointe-Ougree (Belgium). Space Research Group.
PERFORMANCE TESTING OF IMAGE TUBES: ABSOLUTE QUANTUM EFFICIENCY
M. Henrist *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 257-264 ref (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.

For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N79-32097*# Florida Univ., Gainesville. Dept. of Nuclear Engineering Sciences.
RESEARCH ON RADIATION INDUCED LASER PLASMAS Semiannual Report
Richard T. Schneider, Michael J. Rowe, B. Dudley Carter, Roy A. Walters, John D. Cox, Roger Liang, Tim Roxey, and Luis Zapata Sep. 1979 43 p refs
(Grant NsG-1586)
(NASA-CR-162170) Avail: NTIS HC A03/MF A01 CSCL 20I

The development of high power nuclear pumped lasers is discussed. The excitation mechanism of continuous wave (CW) HeNe nuclear pumped lasers is studied and a CO2 nuclear pumped laser is used to demonstrate the CW output in the order of watts. The assumption that high power densities are only achievable by volume fission fragment sources is used to identify laser gases which are compatible with UF6 by excited states lifetime measurements. The examination of Xe2, XeF, and KrF

under nuclear irradiation to determine if they are good candidates for nuclear-pumped lasers is described. A.W.H.

N79-32098# Nagoya Univ. (Japan). Inst. of Plasma Physics.
SINGLE PARTICLE MOTION IN A TOROIDAL STELLARATOR
Y. Abe, K. Matsuoka, M. Sato, and K. Miyamoto May 1979 25 p refs
(IPPJ-397) Avail: NTIS HC A02/MF A01

A computer code, which saves computational time a great deal, was developed to study particle behaviors in a toroidal stellarator in the drift approximation. With the use of this code, the motion of blocked and localized particles in an ordinary eta sub t > eta sub n stellarator and transit banana and superbanana in an eta sub h > eta sub t stellarator is studied and compared with theoretical expectations. Trapped particles in the additional mirror of a modular stellarator are also shown. Author

N79-32099# Nagoya Univ. (Japan). Inst. of Plasma Physics.
SUCCESSIVE BIFURCATIONS TO CHAOTIC STATE IN THE NONLINEAR EVOLUTION OF COLLISIONAL DRIFT WAVE
Fujio Kako and Mitsuo Kono Jun. 1979 31 p refs
(IPPJ-398) Avail: NTIS HC A03/MF A01

The successive bifurcations from a stationary state to a chaotic state in the nonlinear evolution of the collisional drift wave are studied using a set of model equations. A truncation scheme is introduced to eliminate numerical instabilities. A model system exhibits an inverted bifurcation for the stability of a fixed point to the case of the 12 mode system and a normal bifurcation in other cases. All cases, though different in the type of bifurcations of fixed points, undergo a sequence of bifurcations, exhibiting single periodic and doubly periodic and aperiodic motions successively. The properties of stochastic states are investigated. A.W.H.

N79-32100# Nagoya Univ. (Japan). Inst. of Plasma Physics.
SPIKY SOLITON IN CIRCULAR POLARIZED ALFVEN WAVE
Y. H. Ichikawa, K. Konno (Nihon Univ., Tokyo), M. Wadati (Tsukuba Univ., Japan), and H. Sanuki Jun. 1979 29 p refs
(IPPJ-399) Avail: NTIS HC A03/MF A01

A new type of nonlinear evolution equation for the Alfven waves, propagating parallel to the magnetic field, is now registered to the completely integrable family of nonlinear evolution equations. Stationary solitary wave solutions for the plane wave boundary condition are presented. The obtained results exhibit peculiar structure of spiky modulation of amplitude and phase, which arises from the derivative nonlinear coupling term. A nonlinear equation for complex amplitude associated with the carrier wave is shown to be a mixed type of nonlinear Schroedinger equation, having an ordinary cubic nonlinear term and the derivative of cubic nonlinear term. A.R.H.

N79-32101# Nagoya Univ. (Japan). Inst. of Plasma Physics.
ON STEADY OPERATION OF FIELD REVERSED CONFIGURATIONS
Kazunari Ikuta Jun. 1979 14 p refs
(IPPJ-400) Avail: NTIS HC A02/MF A01

A method of sustaining toroidal current by the use of energetic ions in field reversed mirror configuration is considered. Since no charge-neutralizer is required in this method, the reactor system will be drastically simplified. Author

N79-32102# Nagoya Univ. (Japan). Inst. of Plasma Physics.
ELECTROMAGNETIC DRIFT WAVE TURBULENCE AND CONVECTIVE CELL FORMATION
H. Sanuki and J. Weiland Jun. 1979 30 p refs
(IPPJ-401) Avail: NTIS HC A03/MF A01

A model equation for nonlinear drift Alfven waves in the region where they do not couple to the electrostatic drift wave branch is derived. Two conservation relations are derived and the results are compared to that of the Hasegawa-Mima equation. The spectrum is found to cascade to both smaller and larger k. The convective cell formation is studied for two different orderings of the parameters. The relation between characteristic scale lengths parallel and perpendicular to the drift flow for the onset of cell formation is found. K.L.

N79-32103# Nagoya Univ. (Japan). Inst. of Plasma Physics.
DEFLAGRATION WAVE FORMED BY ION BEAM. PART 1: IN SLAB TARGET
T. Abe, K. Kasuya, K. Niu, and M. Tamba Jun. 1979 31 p refs
(IPPJ-402-Pt-1) Avail: NTIS HC A03/MF A01

Structures of deflagration waves in slab targets under exposure to ion beams are analyzed for two cases of with and without heat tranfer. The structure of the deflagration wave depends on the two parameters, number density and velocity, of the ion beam. The heat conductivity effects on the wave strength are small but have a significant effect on the wave structure, especially for the cases of small beam velocities. The adiabatic compression of the target is studied by using the ion beam. A.W.H.

N79-32104# Nagoya Univ. (Japan). Inst. of Plasma Research.
DEFLAGRATION WAVE FORMED BY ION BEAM. PART 2: IN SPHERICAL TARGET
T. Abe (Tokyo Inst. of Tech.), K. Kasuya (Tokyo Inst. of Tech.), K. Niu (Tokyo Inst. of Tech.), and M. Tamba (Inst. of Physical and Chemical Research, Saitama, Japan) Jun. 1979 17 p refs
(IPPJ-403-Pt-2) Avail: NTIS HC A02/MF A01

Analyses are given for structures of deflagration waves formed by ion beams in spherical targets. The singularity at the sonic point disappears in the spherical target if the beam pressure is in balance with the plasma pressure. The expanding supersonic flow of the background plasma can be connected with the subsonic flow in the core of the target through the deflagration wave. The length and the strength of the deflagration wave in the spherical target is comparable with the corresponding ones in the slab target. Author

N79-32105# California Univ., Livermore. Lawrence Livermore Lab.
POWER PLANT PRODUCTION OF INERTIAL CONFINEMENT FUSION TARGETS
C. D. Hendricks and W. L. Johnson 15 Feb. 1979 15 p refs
(Contract W-7405-eng-48)
(UCRL-52539) Avail: NTIS HC A02/MF A01

The techniques for fabricating inertial fusion targets are reported. A summary of the parameters and the degree of accuracy in the target measurements are listed. The projected specifications of reactor grade targets are examined. A.W.H.

N79-32106# Los Alamos Scientific Lab., N. Mex.
TESTS OF VACUUM INTERRUPTERS FOR THE TOKAMAK FUSION TEST REACTOR
R. Warren, M. Parsons, E. Honig, and J. Lindsay Apr. 1979 34 p refs
(Contract W-7405-eng-36)
(LA-7759-MS) Avail: NTIS HC A03/MF A01

The Tokamak Fusion Test Reactor project at Princeton University requires the insertion of a resistor in an excited ohmic-heating coil circuit to produce a plasma initiation pulse. It is expected that the maximum duty for the switching system will be an interruption of 24 kA with an associated recovery voltage of 25 kV. Vacuum interrupters were selected as the most economical means to satisfy these requirements. However, it was felt that some testing of available systems should be performed to determine their reliability under these conditions. Two interrupter systems were tested for over 1000 interruptions each at 24 kA and 25 kV. DOE

N79-32107# California Univ., Livermore. Lawrence Livermore Lab.
IMPROVED TANDEM MIRROR FUSION REACTOR
D. E. Baldwin, B. G. Logan, and T. K. Fowler Apr. 1979 45 p
(Contract W-7405-eng-48)
(UCID-18156) Avail: NTIS HC A03/MF A01

An improved version of the tandem mirror fusion reactor is presented in which a power gain factor Q similar to 10 to 20 can be obtained at a few 100 MWe electrical output with much simpler technology in the end plugs. The improvement is obtained by raising the electron temperature in the end plugs well above that in the central cell (which would be ignited). The heating

power required to maintain the high electron temperature is greatly reduced to 20 to 40 MW per plug by creating negative depressions in the potential that serve to thermally insulate electrons in the end plugs from those in the central cell. The overall concept and several proposed methods for creating the thermal barriers are discussed. A reactor example is then discussed. DOE

N79-32108# California Univ., Livermore. Lawrence Livermore Lab.
LASER-PLASMA COUPLING
W. L. Kruer 14 Nov. 1978 22 p
(Contract W-7405-eng-48)
(UCRL-81896) Avail: NTIS HC A02/MF A01

The following topics are discribed: (1) ionization of target; (2) electromagnetic wave propagation in plasma; (3) collisional absorption; (4) light absorption in collisionless plasma; (5) resonance absorption; (6) instabilities; (7) Brillouin instability; and (8) some other effects. DOE

N79-32109# Wisconsin Univ., Madison. Dept. of Nuclear Engineering.
TOKAMAK REACTORS AND STRUCTURAL MATERIALS
R. W. Conn Jan. 1979 10 p refs Presented at the 1st Topical Meeting on Fusion Reactor Mater., Miami Beach, Fla., 29-31 Jan. 1979
(Contract ET-78-S-02-4410)
(UWEDM-288; Conf-790125-46) Avail: NTIS HC A02/MF A01

The status of the Tokamak as a reactor concept is reviewed and the relationship between first wall and blanket materials behavior and reactor design is discussed. DOE

N79-32110# Oak Ridge National Lab., Tenn.
EVOLUTION OF FLUX CONSERVING TOKAMAK EQUILIBRIA WITH PREPROGRAMMED CROSS SECTIONS
J. A. Holmes, Y-K. M. Peng, and S. J. Lynch Mar. 1979 46 p refs
(Contract W-7405-eng-26)
(ORNL/TM-6761) Avail: NTIS HC A03/MF A01

The evolution of MHD equilibria toward high beta is modeled by magnetic flux conservation with a given q(psi) and by particle and energy balances which determine p(psi,t). One-dimensional single-fluid transport equations, written with the magnetic flux psi as the independent variable, are coupled to the two-dimensional axisymmetric MHD equilibrium and flux conservation equations through psi and p(psi,t). DOE

N79-32111# Oak Ridge National Lab., Tenn.
RADIAL TRANSPORT IN THE ELMO BUMPY TORUS IN COLLISIONLESS REGIMES
E. F. Jaeger, C. L. Hedrick, and D. A. Spong Apr. 1979 34 p refs
(Contract W-31-109-eng-26)
(ORNL/TM-6806) Avail: NTIS HC A03/MF A01

The lowest order effects of ion diffusion in regions where poloidal drift frequencies are small are included. Effects of direct, or nondiffusive, losses in such regions are neglected. Results show that solutions in the collisionless regime do exist. Furthermore, when effects of finite electron ring beta on magnetic fields near the plasma edge are included, these solutions occur at power levels consistent with experiment. DOE

N79-32112# Naval Research Lab., Washington, D. C.
EMISSION OF ENERGETIC ELECTRONS FROM A Nd-LASER-PRODUCED PLASMA Interim Report
C. M. Armstrong, B. H. Ripin, F. C. Young, R. Decoste, R. R. Whitlock, and S. E. Bodner Aug. 1978 21 p refs
(Contract ES-77-A-01-6021; NRL Proj. H02-29A)
(NRL-MR-3829) Avail: NTIS HC A02/MF A01

Absolute spectral measurements of 50 to 500 keV electrons emitted from a Nd-laser-produced plasma are presented. For normally incident irradiation onto polystyrene slab targets a total emission of approximately 10 to the 10th power electrons was inferred with a total emitted energy of approximately 0.2 mJ. The electron emission was observed to be almost the same both in and out of the plane of polarization. Properties of the emitted spectrum, such as spectra hardness and intensity were observed to be dependent on pulse shape and target material. DOE

N79-32113# Oak Ridge National Lab., Tenn.
OPTIMIZATION OF THE FISSION-FUSION HYBRID CONCEPT
M. J. Saltmarsh, W. R. Grimes, and R. T. Santoro Apr. 1979 56 p refs
(Contract W-7405-eng-26)
(ORNL/PPA-79/3) Avail: NTIS HC A04/MF A01

The role of the fission-fusion hybrid reactor as a fissile fuel producer is discussed. The advantages of the concept in terms of the performance of the fusion device and the breeding blankets are presented. Some of the troublesome features of existing design studies are described. Hybrids based on deuterium-tritium (D-T) fusion devices are unlikely to be economically attractive and present formidable blanket technology problems. An alternative approach based on a semicatalyzed deuterium-deuterium fusion reactor and a molten salt blanket is discussed. This concept is shown to emphasize the desirable features of the hybrid, to have considerably greater economic potential, and to mitigate many of the disadvantages of D-T-based systems. DOE

N79-32114# Los Alamos Scientific Lab., N. Mex.
APPROXIMATE MODEL FOR TOROIDAL FORCE BALANCE IN THE HIGH-BETA STELLARATOR
D. C. Barnes Mar. 1979 22 p refs
(Contract W-7405-eng-36)
(LA-7581) Avail: NTIS HC A02/MF A01

A simple model for estimating the body force acting on a diffuse plasma confined in a three dimensional, high beta stellarator geometry is given. The equilibrium is treated by an asymptotic expansion about a straight theta pinch with diffuse, circular cross section. The expansion parameter delta is the strength of the applied helical fields. This expansion leads to an inconsistent set of equations for the equilibrium in second order. Nevertheless, by averaging the equilibrium equations over the volume of the confined plasma, a condition for toroidal equilibrium is obtained. When the results are compared with the predictions of previous equilibrium theory, which is based on the sharp-boundary model, a large deviation is found. This correction is especially large for 1 = 0,1 systems at high beta and must be accounted for in any confinement experiment. DOE

N79-32115# Cornell Univ., Ithaca, N. Y. Lab. of Plasma Studies.
THEORETICAL STUDIES ON PLASMA HEATING AND CONFINEMENT Progress Report, 16 Oct. 1977 - 15 Oct. 1978
[1979] 375 p refs
(Contract EY-76-S-02-3170)
(COO-3170-7) Avail: NTIS HC A16/MF A01

Results of theoretical plasma heating and confinement studies are discussed. Theory of astron equilibria, ergodic behavior of lower hybrid decay wave ray trajectories in toroidal geometry, and high frequency convective loss-cone instability in short mirror machines are among the topics considered. A method for improved convergence to high beta equilibria in particle simulations, kinetic theory of an ion ring compression, and precession and kink motion of long astron layers are also examined. J.M.S.

N79-32116# Los Alamos Scientific Lab., N. Mex.
NEW RESULTS IN HIGH BETA MHD THEORY
D. C. Barnes, J. U. Brackbill, T. E. Cayton, R. Y. Dagazian, J. P. Freidberg, W. Schneider, Laurance S. Hall, H. Grad, W. Grossmann, D. C. Stevens et al 1978 19 p refs Presented at 7th Conf. on Plasma Phys. and Control, Innsbruck, Austria, 23 Aug. 1978
(Contract W-7405-eng-36)
(LA-UR-78-1963; Conf-780811-5) Avail: NTIS HC A02/MF A01

Results are described in the areas of high magnetohydrodynamic (MUD) theory. Equilibrium and stability of diffuse high-beta stellarators, MHD equilibrium and stability of minimum-beta mirror traps, and simulation of simple and reversed field mirror machines are among the topics covered. DOE

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

N79-32117*# California Inst. of Tech., Pasadena. Seismological Lab.

ANORTHITE: THERMAL EQUATION OF STATE TO HIGH PRESSURES

Raymond Jeanloz and Thomas J. Ahrens [1979] 47 p refs (Grant NsG-9019)

(NASA-CR-162180; Contrib-3275) Avail: NTIS HC A03/MF A01 CSCL 20L

The shock wave (Hugoniot) data on single crystal and porous anorthite ($CaAl_2Si_2O_8$) to pressures of 120 GPa are presented. These data are inverted to yield high pressure values of the Grueneisen parameter, adiabatic bulk modulus, and coefficient of thermal expansion over a broad range of pressures and temperatures which in turn are used to reduce the raw Hugoniot data and construct an experimentally based, high pressure thermal equation of state for anorthite. The hypothesis that higher order anharmonic contributions to the thermal properties decrease more rapidly upon compression than the lowest order anharmonicities is supported. The properties of anorthite corrected to lower mantle conditions show that although the density of anorthite is comparable to that of the lower most mantle, its bulk modulus is considerably less, hence making enrichment in the mantle implausible except perhaps near its base. A.W.H.

N79-32118# California Inst. of Tech., Pasadena. Seismological Lab.

SHOCK EFFECTS IN OLIVINE AND IMPLICATIONS FOR HUGONIOT DATA

Raymond Jeanloz [1979] 59 p refs

Avail: NTIS HC A04/MF A01

Deformation produced in single-crystal olivine samples by shock-wave stresses ranging between 18 and 75 GPa are documented by microscopic and spectroscopic techniques. Significantly, no evidence was found for phase transformation throughout the 'mixed-phase' region (about 25-40 GPa to 70 GPa), contrary to expectations based on the current interpretations of Hugoniot data. Calculations of transformation rates for olivine similar indicate that (reconstructive) phase transformation is highly unlikely under experimental shock conditions and that the Hugoniot data represent highly nonequilibrium states. A crystallographically-based model is presented for the behavior of olivine under shock which successfully reproduces the Hugoniot data and which is in accord with all available observations. According to this model, olivine is compressed into a slightly randomized, olivine-like structure at shock pressures above about 30 GPa and does not undergo a polymorphic transformation or an increase in cation coordination number. Some evidence indicates that many other silicates may behave similarly under shock and also not transform. The results of this study suggest that the current interpretations of shock wave data on silicates and their geophysical applications may need reappraisal. A.R.H.

N79-32119# National Academy of Sciences - National Research Council, Washington, D. C. Solid State Sciences Committee.

MICROSTRUCTURE SCIENCE, ENGINEERING AND TECHNOLOGY Final Report, 1 Jul. - 31 Dec. 1978

1979 305 p refs

(Contract DAAG29-78-C-0032)

(AD-A070308; ARO-16215.1-EL) Avail: NTIS HC A14/MF A01 CSCL 20/12

Microstructure science, engineering, and technology are essential to the continued economic well-being and security of the U. S. A sustained long-range research program directed toward an understanding of the scientific and engineering base on which future technological developments will rest is essential. A greater involvement of universities in microstructure science and engineering is necessary for continued progress in microstructure fabrication, as well as to increase the number of people trained in this field. The general ideas that need new and expanded research include configured materials, characterization and analysis, device physics and electronics system architecture, design pattern generation, information transfer of scientific phenomena, and materials and new instruments. An essential feature of this report is identification of research needs and opportunities. The panel recommends that three complementary types of activities or organizational modes be established to meet national needs in microstructure, science, engineering, and technology. GRA

N79-32120# Illinois Univ. at Urbana-Champaign. Coordinated Science Lab.

STUDIES OF HIGH-DOSE ION IMPLANTATION IN SILICON Ph.D. Thesis

Mon Yen Tsai Sep. 1978 146 p refs

(Contract DAAB07-72-C-0259; Grant NSF DMR-77-22228)

(AD-A069779; R-824; UILU-ENG-78-2217) Avail: NTIS HC A07/MF A01 CSCL 20/2

Properties of high-dose $BF_2(+)$, $Si(+) + B(+)$, and $Ga(+)$ implanted Si are studied by differential resistivity and Hall effect measurements, secondary ion mass spectrometry (SIMS), deep-level transient spectroscopy (DLTS), and Auger electron spectroscopy (AES). GRA

N79-32121# Army Materials and Mechanics Research Center, Watertown, Mass.

MOLYBDENUM-REINFORCED ALUMINUM OXIDE SINGLE CRYSTALS Final Report

James W. McCauley, Frederick Schmid, and Dennis J. Viechnicki May 1979 15 p refs

(DA Proj. 1T1-61102-B-32A)

(AD-A070784; AMMRC-TR-79-23) Avail: NTIS HC A02/MF A01 CSCL 11/4

Molybdenum wire-reinforced aluminum oxide single crystals have been fabricated by the heat exchanger method of seeded unidirectional solidification. No interfacial reaction products were observed and cathodoluminescent evaluation indicated a good diffusion bond. The major problem seems to be thermal expansion mismatch crack networks around the wire. GRA

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

N79-32122*# California Inst. of Tech., Pasadena.

THE CHALLENGE OF DETECTING GRAVITATIONAL RADIATION IS CREATING A NEW CHAPTER IN QUANTUM ELECTRONICS: QUANTUM NONDEMOLITION MEASUREMENTS

Vladimir B. Braginsky (Moscow Univ.), Yu. I. Vorontsov (Moscow Univ.), and Kip S. Thorne [1979] 40 p refs

(Grant NGR-05-002-25; Contract NSF C-310; Grant NSF AST-76-80801)

(NASA-CR-162272) Avail: NTIS HC A03/MF A01 CSCL 12B

Future gravitational wave antennas will be approximately 100 kilogram cylinders, whose end-to-end vibrations must be measured so accurately (10 to the -19th power centimeters) that they behave quantum mechanically. Moreover, the vibration amplitude must be measured over and over again without perturbing it (quantum nondemolition measurement). This contrasts with quantum chemistry, quantum optics, or atomic, nuclear, and elementary particle physics where measurements are usually made on an ensemble of identical objects, and care is not given to whether any single object is perturbed or destroyed by the measurement. Electronic techniques required for quantum nondemolition measurements are described as well as the theory underlying them. Author

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N79-32123# Computer Sciences Corp., Silver Spring, Md.
CENTRAL FLOW CONTROL MANAGEMENT AIDS CODE AUDITOR (MACA) DATA ITEM DICTIONARY Final Report
Jan. 1979 22 p ref
(Contract DOT-FA77WA-3955)
(AD-A069831; CSC/SD-78/6161; FAA-RD-79-38) Avail: NTIS HC A02/MF A01 CSCL 05/1

The functions of the Data-Item Dictionary (DID) generation programs are described and the procedures required to exercise them are detailed. The purpose of the DID programs is to build a dictionary of all COMPOOL items and provide a cross-reference listing of items and modules, showing item-set and/or item-use information. The dictionary is printed on a table basis, and is primarily intended for use by maintenance programming personnel. G.Y.

N79-32124*# California Univ., Livermore. Lawrence Livermore Lab.
AUTOMATING THE ANALYTICAL LABORATORIES SECTION, LEWIS RESEARCH CENTER, NATIONAL AERONAUTICS AND SPACE ADMINISTRATION: A FEASIBILITY STUDY
W. G. Boyle and G. W. Barton 15 Mar. 1979 31 p Sponsored by NASA
(Contract W-7405-eng-48)
(NASA-CR-162183; UCRL-52594) Avail: NTIS HC A03/MF A01 CSCL 05A

The feasibility of computerized automation of the Analytical Laboratories Section at NASA's Lewis Research Center was considered. Since that laboratory's duties are not routine, the automation goals were set with that in mind. Four instruments were selected as the most likely automation candidates: an atomic absorption spectrophotometer, an emission spectrometer, an X-ray fluorescence spectrometer, and an X-ray diffraction unit. Two options for computer automation were described: a time-shared central computer and a system with microcomputers for each instrument connected to a central computer. A third option, presented for future planning, expands the microcomputer version. Costs and benefits for each option were considered. It was concluded that the microcomputer version best fits the goals and duties of the laboratory and that such an automted system is needed to meet the laboratory's future requirements. DOE

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

N79-32125* National Aeronautics and Space Administration, Washington, D. C.
NASA PATENT ABSTRACTS BIBLIOGRAPHY, A CONTINUING BIBLIOGRAPHY. SECTION 1: ABSTRACTS
Jul. 1979 88 p
(NASA-SP-7039(15)) Avail: NTIS HC E04 CSCL 05B

Abstracts are cited for 240 patents and applications for patents introduced into the NASA scientific system during the period of January 1979 through June 1979. Each entry consists of a citation, an abstract, and in most cases, a key illustration selected from the patent or application for patent. A.R.H.

N79-32126* National Aeronautics and Space Administration, Washington, D. C.
NASA PATENT ABSTRACTS BIBLIOGRAPHY, A CONTINUING BIBLIOGRAPHY. SECTION 2: INDEXES
Jul. 1979 635 p
(NASA-SP-7039(15)) Avail: NTIS HC E06 CSCL 05B

Entries for 3632 patents and patent applications for patent citations for the period May 1969 through 1979 are listed. Indexes for subject, inventor, source, number, and accession number are included. A.R.H.

N79-32127# Comptroller General of the United States, Washington, D.C.
DEPARTMENT OF ENERGY'S CONSOLIDATION OF INFORMATION PROCESSING ACTIVITIES NEEDS MORE ATTENTION
3 May 1978 53 p refs
(EMD-78-60) Avail: NTIS HC A04/MF A01

The house Committee on Government Operations asked GAO (Government Accounting Office) to review the Department of Energy's information processing activities. Several recommendations to the Secretary of Energy and to the Congress to improve management of information related activities by the Department of Energy are presented. G.Y.

N79-32128# Rochester Univ., N. Y. Dept. of Computer Science.
A FLEXIBLE DATA STRUCTURE FOR ACCESSORY IMAGE INFORMATION
Peter G. Selfridge May 1979 31 p refs
(Contract N00014-78-C-0164)
(AD-A069823; TR-45) Avail: NTIS HC A03/MF A01 CSCL 05/8

A simple and powerful system for keeping track of derived images and accessory information about images has been designed and implemented. It takes advantage of extra room in image file headers to store information in the form of NAME-TYPE-VALUE triples. The NAME is a string name for the triple, the TYPE an integer designating the type, and thus the internal format, of the VALUE. This report describes the format and use of NTV information, including design decisions, current uses, and user software available. Future uses are also described. GRA

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

No abstracts in this category.

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

No abstracts in this category.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

N79-32129*# Detroit Diesel Allison, Indianapolis, Ind.
SINGLE SHAFT AUTOMOTIVE GAS TURBINE ENGINE CHARACTERIZATION TEST Final Report
R. A. Johnson Sep. 1979 103 p Prepared for NASA and DOE
(Contracts DEN3-4; EC-77-A-31-1040)
(NASA-CR-159654; DDA-EDR-9790; DOE/NASA/0004-79/1) Avail: NTIS HC A06/MF A01 CSCL 13F

An automotive gas turbine incorporating a single stage centrifugal compressor and a single stage radial inflow turbine is described. Among the engine's features is the use of wide range variable geometry at the inlet guide vanes, the compressor diffuser vanes, and the turbine inlet vanes to achieve improved part load fuel economy. The engine was tested to determine its performance in both the variable geometry and equivalent fixed geometry modes. Testing was conducted without the originally designed recuperator. Test results were compared with the predicted performance of the nonrecuperative engine based on existing component rig test maps. Agreement between test results and the computer model was achieved. A.W.H.

N79-32130*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THREE STATE-OF-THE-ART INDIVIDUAL ELECTRIC AND HYBRID VEHICLE TEST REPORTS, VOLUME 2
Nov. 1978 329 p refs
(Contract EC-77-A-31-1011)
(NASA-CR-162311; HCP/M1011-03/2-Vol-2) Avail: NTIS HC A15/MF A01

Procedures used in determining the energy efficiency and economy of a gasoline-electric hybrid taxi, an electric passenger car, and an electric van are described. Tabular and graphic data show results of driving cycle and constant speed tests, energy distribution to various components, efficiency of the components, and, for the hybrid vehicle, the emissions. A.R.H.

N79-32131# Sandia Labs., Albuquerque, N. Mex.
PROBLEMS OF TECHNOLOGY TRANSFER TO INDUSTRY
1979 15 p refs Presented at the 6th Energy Technol. Conf. and Exposition, Washington, D.C., 26 Feb. 1979
(Contract EY-76-C-04-0789)
(SAND-79-0096; Conf-790213-1) Avail: NTIS HC A02/MF A01

The following are discussed: solar energy utilization, technology development, technology transfer, and problems with technology transfer. Examples of technology development and transfer to industry are given. DOE

N79-32132# Oak Ridge National Lab., Tenn.
SOLID WASTE HANDLING AND DECONTAMINATION FACILITY
R. E. Lampton 1979 14 p
(Contract W-7405-eng-26)
(CONF-790331-4) Avail: NTIS HC A02/MF A01

Design criteria listed for the decontamination section of the SWH and D facility is underway. A flowsheet is given of the solid waste reduction. The incinerator scrubber is described. Design features of the Gunite Tank Sludge Removal and a schematic of the sluicer, TV camera, and recirculating system are given. DOE

N79-32133# Michigan Univ., Ann Arbor. Inst. of Science and Technology.
REPORT ON THE SUBSTITUTION OF ALUMINUM AND OTHER LIGHTWEIGHT MATERIALS IN AUTOMOTIVE PRODUCTION: INCLUDING A CENSUS OF CAST IRON AUTOMOTIVE PARTS, MICHIGAN, PHASE 2
Marian J. Krzyzowski, William E. Hobson, and Lawrence T. Harbeck Apr. 1979 98 p refs
(Grant EDA-06-06-01522)
(PB-295430/3; EDA-79-0100) Avail: NTIS HC A05/MF A01 CSCL 13F

Phase 2 focused on two main areas: identifying specific automotive components which are likely to be converted from ferrous to aluminum castings along with their associated weights; and, assessing some of the opportunities and limitations of converting ferrous casting operations to aluminum with special attention to die casting. GRA

N79-32134# Dynamic Science, Phoenix, Ariz.
PARATRANSIT VEHICLE TEST AND EVALUATION. VOLUME 1: RIDE COMFORT AND QUALITY TESTS Final Report, Nov. 1976 - Aug. 1977
L. Wesson, C. Culley, and R. L. Anderson Jun. 1978 216 p 5 Vol.
(Contract DOT-TSC-1241)
(PB-295475/8; UMTA-MA-06-0052-78-1; DOT-TSC-UMTA-77-49-1) Avail: NTIS HC A10/MF A01; also available in set of 5 reports HC E14 as PB-295474-SET CSCL 13F

The test procedures and results of the ride comfort and quality test series were presented. The ride characteristics of the test vehicles were measured. The standards for ride quality were determined. The tests measured the ride characteristics of the two protoype vehicles and a baseline passenger car as they were driven at controlled speeds over a specially constructed ride course. The vibratory motions impacted to the driver and passengers were evaluated against the criteria in International Standard ISO 2631 for driver fatigue and passenger comfort. GRA

N79-32135# Dynamic Science, Phoenix, Ariz.
PARATRANSIT VEHICLE TEST AND EVALUATION. VOLUME 4: FUEL ECONOMY TESTS Final Report, Nov. 1976 - Jul. 1977
L. Wesson, C. Culley, and R. L. Anderson Jun. 1978 51 p 5 Vol.
(Contract DOT-TSC-1241)
(PB-295478/2; UMTA-MA-06-0052-78-4; DOT-TSC-UMTA-77-49-4) Avail: NTIS HC A04/MF A01; also available in set of 5 reports HC E14 as PB-295474-SET CSCL 13F

A series of tests and evaluations of two prototype vehicles for paratransit were conducted. The test procedures and results of the fuel economy tests are presented. The test series determined the fuel economy of the vehicles as they were driven through simulated urban and suburban driving cycles. The relationships between fuel consumption and vehicle speeds were determined and maximum fuel economies were established. GRA

N79-32136# Hazeltine Corp., Greenlawn, N. Y.
FIELD TESTING OF A PULSE TRILATERATION AUTOMATIC VEHICLE MONITORING SYSTEM IN PHILADELPHIA. VOLUME 1: EXECUTIVE SUMMARY Final Report, Sep. 1976 - Feb. 1977
James F. OConnor and Alexander H. Riccio Aug. 1978 29 p 2 Vol.
(Contract DOT-TSC-1236)
(PB-295610/0; UMTA-MA-06-0041-77-4-Vol-1; DOT-TSC-UMTA-77-36-Vol-1) Avail: NTIS HC A02/MF A01 CSCL 13F

Automatic Vehicle Monitoring (AVM) is an important part of an overall command and control system for vehicle fleet management as it automatically provides the system operator and/or dispatcher with timely information on the location and status of all vehicles to be controlled. The Pulse Trilateration AVM system is described, and results of the Phase test program in Philadelphia are presented. GRA

N79-32137# Hazeltine Corp., Greenlawn, N. Y.
FIELD TESTING OF A PULSE TRILATERATION AUTOMATIC VEHICLE MONITORING SYSTEM IN PHILADELPHIA. VOLUME 2: TEST RESULTS AND DATA Final Report, Sep. 1976 - Feb. 1977
James F. OConnor and Alexander H. Riccio Aug. 1978 266 p 2 Vol.

(Contract DOT-TSC-1236)
(PB-295611/8; UMTA-MA-06-0041-77-5-Vol-2; DOT-TSC-UMTA-77-36-Vol-2) Avail: NTIS HC A12/MF A01 CSCL 13F

The Pulse Trilateration Automatic Vehicle Monitoring (AVM) system is described, and results of the Phase 1 test program in Philadelphia are presented. Volume 2 presents the Philadelphia Phase 2 test results and data. It describes the AVM system and the test configuration in detail, explains the data analysis and reduction techniques used, and proposed changes which would be made in the system prior to Phase 2. GRA

N79-32138# Nebraska Univ. - Lincoln. College of Engineering and Technology.
THE DEVELOPMENT OF AN EVALUATION FRAMEWORK FOR TRANSPORTATION SYSTEM MANAGEMENT STRATEGIES Final Report, Aug. 1977 - 1978
Peter M. Lima, Patrick T. McCoy, and Steven R. Jepsen Aug. 1978 177 p refs Sponsored by DOT
(PB-295023/6; UMTA-NE-11-0001-79-1) Avail: NTIS HC A09/MF A01 CSCL 13B

A systems analytic approach was applied and six specific tasks were undertaken to construct a framework for: (1) the identification of specific transportation objectives which can be achieved through various TSM strategies; (2) the construction of a set of TSM performance measures or measures of effectiveness which are sensitive to TSM objectives; (3) the identification of a set of techniques to monitor the performance of TSM strategies; (4) the development of a decision rule which can be used to evaluate overall performance of TSM strategies; (5) the testing of monitoring techniques for various TSM strategies; and (6) the development of an information system for the collection, retention, and retrieval of TSM information. GRA

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N79-32139# Telespazio, S.p.A., Rome (Italy).
OBJECTS CLASSIFICATION: SOME METHODS OF INTEREST IN ASTRONOMICAL IMAGE ANALYSIS
Angelo Zandonella Jun. 1979 14 p refs Presented at the Intern. Workshop on Image Process. in Astron., Miramare, Italy, Jun. 1979
Avail: NTIS HC A02/MF A01

The general elements of an object classification problem and its possible mode of solution are examined from a mathematical point of view. Some of the techniques which may be used in astronomical image analysis are summarized. G.Y.

N79-32140# Weather Wing (5th), Langley AFB, Va.
COMPUTING BASIC SOLAR AND LUNAR DATA FROM THE AIR ALMANAC Final Technical Note
John K. Sanders and Charles R. Elliott Jun. 1979 75 p
(AD-A070925; Rept-5WW-TN-79-002) Avail: NTIS HC A04/MF A01 CSCL 17/7

This technical note provides programmed instruction on use of The Air Almanac to compute times of sunrise, sunset, moonrise, moonset, and duration of civil twilight at any location between latitudes 60 deg S and 90 deg N. Appropriate basic astronomy is included. Author (GRA)

N79-32141# Los Alamos Scientific Lab., N. Mex.
VARIABLE STAR RESEARCH AT LOS ALAMOS
C. G. Davis, A. N. Cox, and T. F. Adams 1978 12 p refs Presented at the Intern. Astron. Union Colloq. no. 46 on Changing Trends in Variable Star Res., Hamilton, New Zealand, 17 Nov. - 1 Dec. 1978
(Contract W-7405-eng-36)
(LA-UR-78-3089; Conf-781175-1) Avail: NTIS HC A02/MF A01

Three major areas of variable star research are reviewed: (1) a study using improved Cepheid light curves in order to define more precisely the Hertzsprung sequence; (2) the suggestion that helium enrichment occurs in the stellar envelope, by a stellar wind, which may explain many of the mass anomalies; and (3) the study of Cepheid and RR Lyrae colors to compare directly to the observations. A brief discussion of the status of each of these research programs is given. DOE

N79-31669# Max-Planck-Institut fuer Astronomie, Heidelberg (West Germany).
INFRARED OBSERVATIONS WITH THE BALLOON-BORNE TELESCOPE THISBE
D. Lemke, W. Hofman, and A. Frey *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 249-251 refs (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

N79-31670# Max-Planck-Institut fuer Astronomie, Heidelberg (West Germany).
ASTRO 7: SIGNIFICANT RESULTS ON ZODIACAL LIGHT AND GALACTIC LIGHT
E. Pitz, C. Leinert, A. Schulz, and H. Link *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitides Jun. 1978 p 253-256 refs (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

N79-31692# Geneva Observatory (Switzerland).
ASTRONOMICAL NACELLE STABILIZED BY MEANS OF AN ULTRAVIOLET DETECTOR WITH A PHOTOMULTIPLIER [NACELLE ASTRONOMIQUE STABILISEE AVEC DETECTEUR UV A GALETTE DE MICROCANAUX]
D. Hugenin and A. Magnan (Lab. d'Astron. Spatiale) *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 403-406 In FRENCH (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

N79-31695# Max-Planck-Institut fuer Extraterrestrische Physik, Garching (West Germany).
X-RAY EXPERIMENT ASTRO-8
H. Hippmann and U. Zimmermann *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 419-422 refs (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N79-32142# California Univ., Livermore. Lawrence Livermore Lab.
EVOLUTION AND EXPLOSION OF MASSIVE STARS
T. A. Weaver and S. E. Woosley Dec. 1978 43 p refs Presented at the 13th Texas Symp. on Relativistic Astrophys., Munich, 14-19 Dec. 1979
(Contract W-7405-eng-48; Grant NSF AST-76-10933)
(UCRL-82057-Rev-1; Conf-781245-2) Avail: NTIS HC A03/MF A01

An attempt is reported to build self-consistent evolutionary models of complete massive stars, starting from their observable zero-age main sequence configurations, and evolving through their various hydrostatic nuclear burning stages, iron core collapse, bounce, outward-going shock formation, and finally, explosive nucleosynthesis and supernovae light curve formation. The nodel incorporates implicit hydrodynamics with a treatment of

time dependent convection and semiconvection, and a careful treatment of the complexities of the advanced stages of stellar burning. The model was used to completely evolve population I stars of 15 and 25 M/sub solar mass/, with excellent agreement with the known properties and the prediction of other properties. . DOE

N79-31668# Centre d'Etude Spatiale des Rayonnements, Toulouse (France).
HIGH ENERGY ASTROPHYSICS IN EUROPE, USING BALLOONS
G. Vedrenne *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 237-247 refs (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

N79-31672# Ruhr Univ., Bochum (West Germany). Inst. d'Astronomisches.
THE GALACTIC STRUCTURE IN THE EXTREME ULTRAVIOLET (RESULTS AND FUTURE PROGRAMS)
W. Schlosser *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 265-266 (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

N79-31673# Bonn Univ. (West Germany). Inst. fuer Astrophysik.
ASTRO-HEL: A NEW PAYLOAD FOR HIGH RESOLUTION EUV RADIATION ANALYSIS
H. J. Fahr and G. Lay *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1979 p 267-275 refs Sponsored by Bundesmin. fuer Forsch. u. Technol. Prepared in cooperation with Tuebingen Univ., West Germany (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

N79-31674# Bonn Univ. (West Germany). Inst. fuer Astrophysik.
ASTRO 6: HELIUM RESONANCE RADIATION OBSERVATIONS WITH A BLACK BRANT 4b ROCKET
G. Lay, H. J. Fahr, and C. Wulf-Mathies *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 277-281 refs Sponsored by Bundesmin. fuer Forsch. u. Technol. (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N79-32143*# Massachusetts Inst. of Tech., Cambridge. Dept. of Earth and Planetary Sciences.
MICROCRACKS IN LUNAR ROCKS Final Report, 1 Feb. 1971 - 30 Jun. 1979
Gene Simmons 25 Sep. 1979 7 p refs
(Grant NGR-22-009-540)
(NASA-CR-162277) Avail: NTIS HC A02/MF A01 CSCL 03B

Lunar samples contain abundant open microcracks that have closure characteristics completely unlike any shocked terrestrial rock; however, the microcracks present in the lunar rocks before the rocks reached the surface of the moon were likely similar to the microcracks in the shocked terrestrial rocks. Because the microcracks present in the lunar rocks in situ inside the moon were different, radically different, from the microcracks present today in returned lunar samples, any property that is sensitive to microcracks measured on the returned lunar samples is inappropriate for predicting that property as a function of depth in the moon. Therefore, many data that have been measured already on lunar samples simply do not apply to rocks in situ inside the moon. A plausible mechanism with which to account for the difference in microcrack characteristics of lunar samples on the surface of the moon and the microcrack characteristics of lunar rock in situ inside the moon is thermal cycling during residence on the moon's surface. Author

N79-32144*# Eyring Research Inst., Provo, Utah.
LUNAR PHYSICAL PROPERTIES FROM ANALYSIS OF MAGNETOMETER DATA Final Report, 1 Nov. 1975 - 31 Aug. 1979
William D. Daily 31 Aug. 1979 173 p refs
(Grant NsG-2082)
(NASA-CR-162288; ERII-800-0045) Avail: NTIS HC A08/MF A01 CSCL 03B

The electromagnetic properties of the lunar interior are discussed with emphasis on (1) bulk, crustal, and local anomalous conductivity; (2) bulk magnetic permeability measurements, iron abundance estimates, and core size limits; (3) lunar ionosphere and atmosphere; and (4) crustal magnetic remanence: scale size measurements and constraints on remanence origin. Appendices treat the phase relationship between the energetic particle flux modulation and current disc penetrations in the Jovian magnetosphere (Pioneer 10 inbound) theories for the origin of lunar magnetism; electrical conductivity anomalies associated with circular lunar maria; electromagnetic properties of the Moon; Mare Serenitatis conductivity anomaly detected by Apollo 16 and Lunokhod 2 magnetometers; and lunar properties from magnetometer data: effects of data errors. A.R.H.

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N79-32145*# Stanford Univ., Calif. Inst. for Plasma Research.
RADIATIVE DOMINATED COOLING OF THE FLARE CORONA AND TRANSITION REGION
S. K. Antiochos Aug. 1979 26 p refs
(Contract NAS8-32263; Grants NGL-05-020-272; NGR-05-020-559)
(NASA-CR-162171; SU-SUIPR-792) Avail: NTIS HC A03/MF A01 CSCL 03B

Models in which radiation dominates cooling flare loops are investigated. The radiative models are found to predict a differential emission measure (Q) proportional to T to the (l+1) power, where l measures the dependence of the radiative loss coefficient on temperature, lamda (T) approximately T to the (-l) power. It is concluded that the radiative models are incapable of explaining the observed temperature dependence of Q for flare coronal and transitional plasma. The models suggest that large mass motions (velocities of the order of the sound speed) may be required. K.L.

N79-32146*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
RESULTS OF CORONAL HOLE RESEARCH: AN UPDATE
Robert M. Wilson Jul. 1979 96 p refs
(NASA-TM-78237) Avail: NTIS HC A05/MF A01 CSCL 03B

Annotated abstracts are presented for 221 papers containing results obtained during the 1976 period. Citations are included for 21 additional reports not reviewed. A.R.H.

N79-32147# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
SOLAR ECLIPSE 1979. ATMOSPHERIC SCIENCES LABORATORY PROGRAM OVERVIEW
Melvin G. Heaps, Robert O. Olsen, and Warren W. Berning Feb. 1979 41 p refs
(DA Proj. 1L1-61102-B-53A)
(AD-A068723; ERADCOM/ASL-TR-0026) Avail: NTIS HC A03/MF A01 CSCL 03/3

The 1979 solar eclipse provides a unique opportunity to better understand the interrelationship of many factors which influence the chemical, physical, and electrical structure of the earth's middle atmosphere. An eclipse provides a day-'night'-day transition on the time scale of a few minutes, thus allowing the rapid processes which affect the electron and ion chemistry to be monitored, while assuring that the bulk properties of the neutral atmosphere vary in a regular and predictable manner. Experimental findings from past eclipses have indicated that a very rapid electron attachment/detachment process exists in the D-region which is not reproduced in our present models and yet needs to be explained because of its potential impact on Army communication systems and nuclear weapons effects studies. To better understand these properties of the middle atmosphere, the Atmospheric Sciences Laboratory is helping to coordinate a field experiment program for the 26 February 1979 solar eclipse. GRA

N79-32148# Los Alamos Scientific Lab., N. Mex.
ELECTRON CHARACTERISTICS IN THE HIGH SPEED SOLAR WIND
W. C. Feldman 1978 10 p refs Presented at 4th Intern. Conf. on Solar Wind, Burghausen, West Germany, 28 Aug. 1978
(Contract W-7405-eng-36)
(LA-UR-78-3043; Conf-780890-2) Avail: NTIS HC A02/MF A01

Experimental work on the physics of electrons in the high speed solar wind is reviewed. Results show that most electron parameters are uniform in the high speed solar wind indicating that it is a well defined, structure-free state of the coronal expansion. The higher energy unbound part of electron velocity distributions (the halo) is consistent with nearly collisionless propagation to 1 AU from some heliocentric distance in the range between about 10 and 30 solar radii. The low energy bound electron (core) component appears to be strongly coupled to the protons as well as to one another through Coulomb and wave electron collisions. The first measured radial profile of the core-electron temperature in the high speed solar wind is best characterized in terms of two separate power laws applicable in the distance ranges between 0.47 and 0.62 AU and between 0.62 and 1.0 AU respectively. DOE

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N79-32149*# National Aeronautics and Space Administration, Washington, D. C.
SPECTROMETER OF HIGH ENERGY GAMMA QUANTUMS
I. D. Blokhintsev, A. S. Melioranskiy, L. F. Kalinkin, Yu. I. Nagornykh, and Y. A. Pryakhin Aug. 1979 32 p refs Transl. into ENGLISH of "Spektrometr gamma-kvantov vysokikh energiy" Acad. of Sci. SSSR, Moscow, Rept. PR-416, 1978 25 p Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75647; PR-416) Avail: NTIS HC A03/MF A01 CSCL 03B

A detailed description of the apparatus GG-2M is given. The spectrometer contains a Cerenkov and scintillation (including anticoincidence) counter. The energies of the gamma quantums are measured by a shower calorimeter, in which scintillation counters are used in the capacity of detectors. Results are given for tuning the device on mu-mesons of cosmic rays. The data of physical tuning allow more reliable interpretation of the results of measurements which are received on the satellites. Author

N79-31676# Max-Planck-Institut fuer Extraterrestrische Physik, Garching (West Germany). Inst. fuer Extraterristrische Physik.
LOW ENERGY GAMMA RAY ASTRONOMY AT BALLOON ALTITUDES WITH A COMPTON TELESCOPE
F. Graml, F.-P. Penningsfeld, and V. Schoenfelder *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 287-292 refs (For primary document see N79-31637 22-42)
Avail: NTIS HC A23/MF A01

N79-31678# Max-Planck-Institut fuer Extraterrestrische Physik, Garching (West Germany).
BALLOON OBSERVATION OF THE BINARY X-RAY SOURCE HER X-1 1.24 sec PULSATION AND CYCLOTRON LINE EMISSION
C. Reppin, W. Pietsch, J. Truemper, W. Voges, E. Kendziorra (Tuebingen Univ.), and R. Staubert (Tuebingen Univ.) *In* ESA European Sounding Rocket, Balloon and Related Res. with Emphasis on Expt. at High Latitudes Jun. 1978 p 299-303 refs (For primary document see N79-31637 22-42)
(Grants DFG-Tr-11/14; DFG-Tr-11/15)
Avail: NTIS HC A23/MF A01

99 GENERAL

No abstracts in this category.

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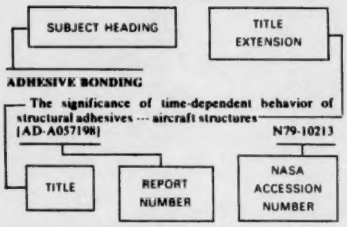

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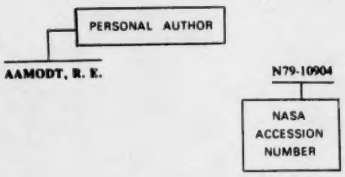

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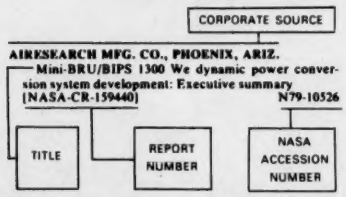

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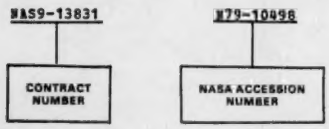

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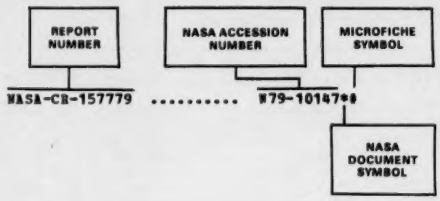

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